APPENDIX B

ECONOMICS ANALYSIS
GENERAL REEVALUATION REPORT
SAINT PAUL SMALL BOAT HARBOR
SAINT PAUL, ALASKA

Prepared for

U.S. Army Corps Of Engineers, Alaska District

Under Contract With Tetra Tech ISG

By

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CONTENTS

TABLES

EXHIBITS

ABBREVIATIONS

ABC	Allowable Biological Catch
ADFG	Alaska Department Of Fish & Game
ADOT	Alaska Department Of Transportation
BSAI	Bering Sea Aleutian Islands
CBSFA	Central Bering Sea Fishermen's Association
CDQ	Community Development Quota
CFEC	Commercial Fisheries Entry Commission
EBS/AI	Eastern Bering Sea/Aleutian Islands
EEZ	Exclusive Economic Zone
F/V	Fishing Vessel
fps	feet per second
ft	foot/feet
ft^2	square feet
FTE	Full Time Equivalent
GHL	Guideline Harvest Level
gph	gallons per hour
hp	horsepower
hr	hour(s)
IFQ	Individual Fishing Quota
I-O	Inboard-Outboard
IPHC	International Pacific Halibut Commission
IRA	Indian Reorganization Act
kW	kilowatt(s)
lb	pound(s)
LLP	Limited License Program
LOA	Length Overall
LRIC	Long Run Incremental Cost
MHHW	Mean Higher High Water
MHW	Mean High Water
MLLW	Mean Lower Low Water
MLW	Mean Low Water
MSL	Mean Sea Level
mt	metric ton
NED	National Economic Development
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRC	Natural Resource Consultants
PNW	Pacific Northwest
TAC	Total Allowable Catch
TDX	Tanadgusix Corporation
WRDA	Water Resources Development Act

EXECUTIVE SUMMARY

Developments in the Bering Sea fishing industry have forced Saint Paul to move rapidly towards development of a small boat harbor able to accommodate vessels (fleet) up to 58 feet. The fleet will operate as a day fleet in the waters surrounding the island. Supported by the advantage of being at the center of the rich Bering Sea fishing grounds, the fleet will target halibut, cod, and crab for commercial and subsistence purposes. A fleet based at Saint Paul will provide transportation efficiencies over alternative ports. Lack of a harbor has restricted the size and number of local vessels.

Seven alternatives were evaluated, and South Village Cove was shown as the most attractive alternative concerning local needs and Corps' guidelines. The South Village Cove has the potential for being developed in phases, and at any scale of development that is economically sound from the local and NED point of view. Significant savings result from a fully developed plan which is demonstrated as having a benefit to cost ratio of 2.4:1. The NED alternative will also provide some relief to harbor congestion and conflicts between smaller and larger vessels vying to use docks at the deep-draft facility. The project will accommodate 60 vessels.

A series of political and business decisions were made in the U.S. and Japan during the 1980s, which structured the full U.S. development of the eastern Bering Sea crab, pollock, cod, and all other groundfish fisheries. When these key political and business decisions were made, Saint Paul was not on the development map from the fishing industry's perspective. Saint Paul, in spite of its location, had no harbor, no fleet, and virtually no infrastructure to support industry development.

Before October 1983, the island was classified as a Federal Government installation. The island was the center of fur sealing activities under the administration of National Marine Fisheries Service (NMFS). National Marine Fisheries Service accounted for more than 60% of the employment on the island, and when they withdrew in 1983, they left behind a community without an economic base.

Seven years later, the deep-draft Saint Paul Harbor was opened. This was in 1990 long after the domestic groundfish industry was fully developed, long after infrastructure investments had been committed, and long after the industry was in full swing at Dutch Harbor and Akutan where it had been built. Even so, the location advantage of Saint Paul attracted some processing, and a crab processor was moved there in 1993. Crab processing facilities were expanded in 1995 and then cut back in 1999. There has been no processing of other species with the exception of a few halibut in 2000.

There is no local harvest income from the crab harvest because the vessels operate out of other ports. There is no local small boat harbor. This has kept the fleet harvest by local fishermen near subsistence levels. To date the local fleet consists of 26 vessels all under 32 feet. With a harbor leading to development of a local fleet, the rich nearby Bering Sea stocks can provide an economic base, stability, employment, and growth. An expanded fleet based at Saint Paul will be the least cost way of harvesting stocks around Saint Paul.

1.0 STUDY SCOPE AND AREA

1.1 Scope of Study

The City of Saint Paul and the Corps share an interest in establishing the viability and Federal interest in development of a small boat harbor consistent with other harbor developments in progress. The shared concern is based on an opportunity for significant savings in mobilization cost should a small boat harbor be constructed concurrent with other work.

The engineering proposals included in this study were limited to proposals for development of a small boat harbor inside of the existing breakwater. The proposed plans were all separable from the completed and under construction (in 2000) deep-draft improvements in the sense they could be considered on a last added basis. None of the proposed small boat harbor alternatives were practical on a first-added basis, because all of the plans required a protected channel to the ocean. The scope of this study therefore included all deep-draft alternatives as if all authorized, under construction or permitted improvements were already in place. The purpose of this report is to support Federal participation in development of a small boat harbor and to identify the best alternative.

1.2 Study Participants

This economic study has been conducted through the cooperation of the City of Saint Paul, the Corps ft Alaska District, Tetra Tech Infrastructure Group, and Kenneth Boire Consulting Economist. Local needs were assessed through meetings with island residents and others who made important technical contributions to the planning process and formed a Citizen Participation Committee. Major contributors to the study include staff at the City of Saint Paul, The Aleut Community of Saint Paul, Pribilof Bering Seafood, Bering Sea Eccotech, Central Bering Sea Fishermen Association, Tanadgusix (TDX) Corporation, Alaska Department of Fish & Game, Island Stewardship Program, National Marine Fisheries Service, North Pacific Fisheries Management Council, International Pacific Halibut Commission, Natural Resource Consultants, and Waterfront Associates. Informally established protocol included coordination with the Alaska District Corps of Engineers through Clarke Hemphill, Project Manager at the time, and Andy Miller, Chief Economist at the time. Coordination with the City of Saint Paul was through Char Kirkwood, City Planner and John Merculief, City Manager. Coordination with the Citizen Participation Committee was through members at large of the Aleut Community of Saint Paul Island, Central Bering Sea Fishermen's Association, TDX Corporation, and the City of Saint Paul.

1.3 Location and Socioeconomic Setting

Saint Paul Island is in the eastern Bering Sea of Alaska, about 775 air miles west of Anchorage and 275 miles north of Dutch Harbor. The rocky, treeless, island has a land area of 44 square miles. It and a smaller adjacent island, Saint George, are the only islands in the Pribilof group, which are populated. Saint Paul has a resident population that fluctuates between 500 and 750. Population in 2000 has been reported to be 585. About 79% are Alaska Natives. The island has a fish processing industry, which imports several hundred seasonal workers when operating at peak production levels. Most of the processing workers are imported for seasonal jobs.

Before October 1983, the island was classified as a Federal Government installation. The island was the center of fur sealing activities under the administration of National Marine Fisheries Service (NMFS). National Marine Fisheries Service accounted for more than 60% of the employment on the island, and when they withdrew in 1983, they left behind a community without an economic base. Almost immediately the residents began to establish themselves as a strong, self-directed, viable community independent of NMFS.

The residents pulled together, and the City of Saint Paul proved itself as a forward thinking, active, and positive force. The City now provides utility services and numerous community services, including cooperation in health, housing, education, and environmental awareness. The City planning staff and management have been essential to the success of Saint Paul as an American city that works.

1.4 Economic Base

Despite a dedicated effort, the island has not fully developed a stable locally owned economic base. It has many low paying seasonal jobs to offer, and local managers must import workers to keep the food processing factories running. Existing local industry is the result of city development of a harbor to accommodate large fish catching and processing vessels. About 79% of adult residents have income from some form of employment, with the largest number involved in government, some 36%. Employment in local government is large because the government role is woven into almost every aspect of the local economy, which is based on the fishing industry. The island economy is closely tied to a transient fishing fleet and elements of the economy function as a trans-shipment point and processing station. Management of this industry support role is a focal point for local government. Major sectors of employment of island residents in the local economy are summarized below.

Table 1. Major Sectors of Employment

Sector	% Employed
Local Government	36
Education	19
Services	14
Trade	12
Fishing	18

At the time of the NMFS pullout, there was no harbor on the island. Supply ships had to anchor out and be unloaded to open skiffs, which took the cargo to the beach where it was carried ashore. Lack of a harbor kept a local fleet from developing, because sea conditions are too harsh for beachable skiffs. When the city developed the deep-draft harbor to create its own opportunity to enter the fishing industry, everything was scaled to the Bering Sea crab vessels and large trawlers of the groundfish industry. Even after the harbor was constructed, the protected area was far too rough to accommodate smaller vessels that the island residents were interested in owning, and able to afford for subsistence fishing. Today the fragile island economy is almost totally dependent on the boom–bust cycles of the trawler fleet and crab vessels that call at Saint Paul to off-load and re-provision. With a small boat harbor, the island residents will be able to look forward to participation in the fishing industry as owners of modern harvesting vessels.

The most recent data available shows average household earned income among the island permanent residents was $39,900 in 1999, and average income per employed person was $18,100.

Problems and opportunities of the community are tied to the resources of the Bering Sea. Therefore, the study area includes the Bering Sea area available to harvesters who would operate from Saint Paul, and the area of those based elsewhere but who would deliver to processors based at Saint Paul. Also included are the alternative harbors that would be used in the absence of Saint Paul. The most likely alternative harbor is Dutch Harbor, about 275 miles across the Bering Sea, to the south.

1.5 Environmental Setting

An estimated 250,000 sea birds of 11 species use Saint Paul Island for nesting and rearing young. The most abundant species are thick-billed murre, common murre, black-legged kittiwake, parakeet auklet, and least auklet. A large least auklet colony exists on Village Cove beach. Lesser numbers of waterfowl, shore birds, and songbirds are found on the island either as migrants or residents. Salt Lagoon, the only salt estuary in the Bering Sea, is an important resource for migrating sandpipers and turnstones as well as migratory Eurasian species. Waterfowl occasionally use the freshwater ponds on Saint Paul Island.

Land mammals inhabiting Saint Paul Island include reindeer, house mouse, Pribilof shrew, and arctic fox (blue phase). Reindeer were transplanted to Saint Paul Island in 1911 to provide subsistence meat for the Native population. Reindeer now roam freely on the island and are managed by the Saint Paul tribal government. Foxes are relatively abundant, particularly near bird colonies and on the main breakwater.

Northern fur seals, Steller sea lions, and harbor seals are abundant on Saint Paul Island during portions of the year. The northern fur seal is the most abundant. Seals come to the Pribilofs for breeding and pupping from early May to October, feeding within a 200-mile radius of the islands. Fur seals began migrating toward Southern California and Northern Japan during October and remain at sea until returning to the Pribilofs in May. They feed on anchovy, hake, herring, Alaska pollock, and other fish and squid. Other marine mammals, principally whales and porpoises, frequently are observed offshore at Saint Paul. Fur seals are seen inside the harbor and in the entrance to Salt Lagoon.

1.5.1 Endangered and Threatened Species

Two species of birds, six species of whales, and one sea mammal listed in the “United States List of Endangered and Threatened Wildlife and Plants” have been reported on or in the vicinity of the Pribilof Islands. The short-tailed albatross is reported as accidental in the Pribilofs, while a confirmed sighting of the Eskimo curlew has not occurred since the late 1880s. The six whales are the blue, finback, sei, humpback, right, and sperm. The sea mammal is the Steller sea lion, which occurs at two locations on Saint Paul Island but not in the vicinity of the harbor.

1.5.2 Climate

The climate is maritime, resulting in considerable cloudiness, heavy fog, high humidity, and restricted daily temperature fluctuations. The humidity remains uniformly high from May to late September. There is almost continuous low cloudiness and occasional heavy fog during summer months. The maritime influence in the Pribilofs keeps seasonal temperatures mild, and daily variations are kept to a minimum.

The island area has periods of high wind throughout the year. Frequent storms occur from October to April, often accompanied by gale-force winds to produce blizzard conditions. Under the influence of prolonged north and northeast winds between January and May, the sea ice occasionally moves south to surround the island.

1.5.3 Ice Conditions

The icepack in the Northern Bering Sea occasionally moves south and on occasion surrounds the island during periods of prolonged north and northeast winds between January and May. Mariners are warned by National Oceanic and Atmospheric Administration (NOAA) charts against the possibility of entrapment in Village Cove. An icebreaker has never been necessary for access to the island. It is conceivable that sea ice might possibly interfere with small vessel harvest activity of the proposed day fishery on some days during the months of January through May.

1.5.4 Waves

The existing harbor in Village Cove is in direct alignment with deep-water waves approaching between the west-northwest and southwest sectors. Deep-water waves approaching from the south and southeast sectors are partially sheltered by Saint George Island and Otter Island and would diffract around Reef Point before impinging on the project site. Southerly and southeasterly deep-water waves therefore undergo considerable energy reduction before affecting the project site. Village Cove is in the lee of Saint Paul Island for waves approaching from northwest clockwise through southeast. Waves in the Bering Sea are extremely large, and around the shallower waters of Saint Paul Island, their heights are depth limited during numerous events each year. Maximum wave height, expected near the entrance to the present harbor, is 27 feet. Wave heights in the present harbor are greatly modified by the breakwaters and spending beaches.

1.5.5 Harbor Water Quality

Harbor water quality is dominated by the exchange of tide-generated flow through the harbor on its way to and from Salt Lagoon and by wave driven currents. The Salt Lagoon surface is more than three times that of the harbor and more than double the tidal prism. The harbor waters are generally exchanged in one tidal cycle by just tidal flows. Harbor water is also exchanged by wave-generated setup even under minor storm conditions.

1.5.6 Salt Lagoon Water Quality

Salt Lagoon water quality appears to be dominated by tidal exchange. Because of the small range in tidal elevation and length of the basin, several tide cycles may be required before all the water is exchanged. Mixing of water in the tidal lagoon should be good because waters are shallow, and winds are frequent and strong enough to stir the lagoon from top to bottom. Storm surge causes supplemental exchange in the lagoon and periodic improvement of water quality.

2.0 PROBLEMS OF THE WITHOUT-PROJECT CONDITION

2.1 Existing Harbor

Historically, the island did not have a small vessel fleet until about 1995. During the NMFS years, the island residents depended on NMFS marine mammal programs for employment, and before 1983, the island was classified as a Federal Government installation. When NMFS withdrew in 1983, the community had to find other sources of employment. The community constructed the first deep-draft harbor consisting of a channel, breakwater, and dock in 1986, but the project was ineffective. The Corps of Engineers modified it and put it into service fully in 1995. Until this harbor facility was installed, there was no small vessel fleet at Saint Paul except a few skiffs and traditional skin vessels used to lighter for vessels delivering freight to the island. The local fleet grew from a few open outboard powered skiffs to 26 ft, aluminum, I-O driven vessels in less than a five-year period. Most of the vessels are in the 20 ft to 30 ft class, and they are used in a day fishery for halibut, within sight of the island.

2.2 Local Concerns

The Central Bering Sea Fishermen's Association (CBSFA) is a non-profit corporation originally formed by the halibut fishermen of Saint Paul Island. It has status as the Community Development Group with the purpose of qualifying for regional Community Development Quota (CDQ) allocations. It is open to all residents of the Saint Paul community. The Central Bering Sea Fishermen's Association has been the successful recipient of five CDQ allocations (1992–1993, 1994–1995, 1996–1998, and 1998–2000). All of the owners of Saint Paul based vessels belong to CBSFA.

The Central Bering Sea Fishermen's Association working with other members of the community, established a Citizen Participation Committee, which has developed a plan to deal with the disadvantages of an isolated economy overly dependent on the boom-bust cycles of the Bering Sea crab harvest. The plan includes a strategy for maximizing income from the regional fisheries by developing a diversified harvest-processing complex. The centerpiece of the complex will be the small boat harbor. Local concerns about the without-project condition were documented in public meetings at the community. On behalf of the Citizen Participation Committee, CBSFA has stipulated the problems associated with the without-project condition as follows:

- The fleet is moored at temporary docks. When threatened by wave conditions, the vessels and the docks must be removed from the water. It is a costly and time-consuming operation, and it brings an end to all harvesting. The fleet needs all weather protection for as much of the year as possible.
- Vessel security is a concern, due to theft and vandalism problems related to the large number of short-term visitors. The island has become a popular visiting place for eco-tourists. It is also the host to several hundred temporary workers when local processing facilities are in full swing.
- The smaller vessels must use the deep-draft dock to unload their catch. When they arrive, they must wait for larger vessels to clear the area. Frequently they find themselves

working while vessels in the 100–200 ft class are docking next to them. This can lead to extensive waiting periods, crowding, and safety concerns. There is a need to minimize congestion caused by small vessels using the deep-draft facility.

- The existing temporary dock, launch ramp, and haul-out machinery have a practical limit of 32 ft vessels. Resources next to the island are plentiful, but the small vessels are unsuited to the Bering Sea conditions. Upgrading of the fleet will require a protected moorage and an improved haul-out facility. The Central Bering Sea Fishermen's Association has determined local moorage needs to be for 30–60 or possibly more vessels up to 58 feet.
- The temporary dock is impractical for managing heavy gear. With a protected moorage, a breakwater could be modified to provide for loading and off-loading. It could also serve as a place to tie-up vessels, such as equipment barges too large to fit into the small boat harbor. It could also be used for temporary moorage of disabled or oversized vessels.
- Salt Lagoon is a sensitive environmental area, southeast of the temporary dock and moorage. Small vessel traffic congestion and reefs near the dock could be the cause of accidents, causing pollution spills.
- The temporary floating dock does not have adequate space for all of the local vessels involved in commercial fishing, or aspiring to be involved. A concern of the Aleut Tribal Community is that members have no room to launch or tie-up skiffs for purposes of subsistence harvest. There is no direct economic consequence to the commercial harvest, but there is a consequence in the form of family subsistence hardship. The tribe needs a facility that will support subsistence use.
- There are reefs near the existing docks. The approach is so limited by the reefs that several captains, familiar with the approach, have damaged their vessels. An adequate and safe approach channel is needed in connection with a new moorage facility.
- There is an existing launch ramp, but the surface is broken and sheets of concrete have been displaced, causing an uneven traction surface. The ramp is too narrow to accommodate launch trailers sized to handle the larger vessels. Its use is further discouraged by the fact the ramp terminates at the waters' edge, causing vehicles to be stuck and damaged as they roll off the edge. The launch ramp is not protected from wave action, and it is frequently unusable for that reason.
- Overall, the existing temporary dock has practically no dedicated staging area. There is no designated or reserved area for people waiting to use the launch or waiting to unload equipment onto the dock. The shore side area is not dedicated to providing support for the harbor operation so parking of trucks, trailers, vessels, and gear is neither guaranteed nor secure. This creates a situation where juggling of equipment causes a great deal of lost time and frayed tempers. All of the potential users of a small boat harbor insist that adequate uplands be provided as part of the moorage facility.
- The vessels and the docks must be removed by a rented crane (owned by a local contractor), using an operator and spotter. To be used for haul out, the crane must be moved from a work area to the haul-out location, resulting in high haul-out costs. Limited uplands, causing a bottleneck during the haul out and stretching out the time the crane is

needed, also increases cost. Future users argue that a small boat harbor must provide a means to remove vessels and docks efficiently at low cost.

- The small vessel fleet is required to move anytime space is needed for barges, container vessels, or larger fishing vessels. During the winter crab season, there is no moorage available for local fishermen at all. Potential users of an improved small boat harbor suggest that moorage facilities should be adequate to accommodate the expanded future fleet and that there be space to accommodate disabled vessels unable to leave Saint Paul.
- Dock space is inadequate, and rafting is sometimes required. Since there is no wave and wind protection, the vessels get banged together, and damages are a concern. Damages to vessels and docks cause the cost of harvest to increase unnecessarily. A new harbor would eliminate the damages, which the vessel owners consider to be part of their operating budget. To them, some of the cost appears as lost time since the vessels and docks are removed when there is a threat of storm damages.
- Congestion in the launch process, limited crane services, and ramp limitations stretch out the amount of time it takes to launch the entire fleet. At times, the launch process can be so challenging as to eat away the fair weather window to the point that fishing trips are canceled.
- Since the existing temporary facility is not protected, storms require dock haul out and storage. A new small boat harbor will need to be protected to save the cost of repeated dock haul out.
- The temporary docks and launch facilities are essentially limited to vessels no larger than 32 feet. This limitation of vessel size causes severe limits on the harvest. Larger vessels would be able to venture further out to sea and would be used in a wider range of weather conditions. Larger vessels would also be able to be more effective in targeting more distant stocks and would have higher production rates. Future users of a small boat harbor urge that the harbor be sized to accommodate vessels up to 58 ft by 23 ft by 8 feet.
- The limitation on vessel sizes has caused development of multi-species harvesting to be discouraged. Larger vessels are needed to profitably target cod, halibut, and crab. Since the fisheries occur over an eight to nine month period, large vessels are more likely to be compatible with weather conditions. A desire to capture the advantage of developing a multi-species fishery has caused future users of a new small boat harbor to urge that the harbor be planned in a way that will maximize the time vessels can be left in the water. They maintain that, without a protected moorage facility, they will be unable to compete, and that stocks available adjacent to the island will be harvested by vessels operating out of other ports.
- A repeated concern is that the island lacks a convenient vessel repair facility. Vessel repair, maintenance, and improvements require repair crews to be flown to Saint Paul or require vessels to be taken elsewhere, sometimes under tow or aboard a freighter. The local fleet will become a major source of employment and economic stimulation. For a few weeks in the summer, the halibut fishery conducted by this fleet employs more than 115 residents—by far the largest single source of employment on Saint Paul Island. Yet, the fishermen still use a fleet of vessels less than 32 ft length overall (LOA) in some of

the harshest conditions in the world. Helping the fleet maintain their vessels, is not just an economic issue, but also one of human safety.

An ongoing Vessel Repair and Maintenance project sponsored by CBSFA has been one of the most important undertakings for the local fleet. Currently, the vessel work, done during these clinics, takes place in the open or in a temporary shop. Future users of a small boat harbor have urged that the harbor be planned in such a way that community development of a vessel repair facility can be integrated into the overall harbor plan.

The community has a well-developed land use plan, however, major changes in the management of the island since 1983, and the continued evolution of the island to a self-sufficient economy, have created land use issues. One such land use opportunity that will be complicated by a new small boat harbor will be competition for use of high valued waterfront for income supporting activities. Some of the land is now in use as storage area for marine equipment while local preferences are that development of a harbor should incorporate elements that make use of non-waterfront land for marine equipment storage. This should be done in a way that works to alleviate congestion and conflicts of use by adapting more distant areas for marine equipment storage.

At present large vessels come into the harbor for crew changes and for re-provisioning. The large number of such service calls adds to congestion outside the harbor, in the approach channel, and at the port facility. Because the harbor is very busy, vessels often have to wait outside for dock space to become available. Future users of a small boat harbor have explored the possibility of tending waiting vessels with a water taxi service that would operate out of the small boat harbor. It would move people and supplies to and from waiting vessels, at their option, and would reduce the number of vessel hours spent waiting for service.

3.0 RESOURCE ASSESSMENT AND POTENTIAL LOCAL HARVEST

3.1 Responsible Institutions

Responsibility for management and development of the fishery resources in the study area is shared between Federal, state, and quasi-governmental agencies. These agencies include the National Marine Fisheries Service (NMFS), the North Pacific Fishery Management Council (NPFMC), the Alaska Department of Fish and Game (ADF&G), and the International Pacific Halibut Commission (IPHC). The Magnuson Fishery Conservation and Management Act of 1976 (Public Law 94-265, as amended), often referred to as the Magnuson Act, provides for the conservation and exclusive management of all fishery resources within the U.S. Exclusive Economic Zone (EEZ). The U.S. EEZ extends from the seaward boundaries of the territorial sea (3 nautical miles from shore) to 200 nautical miles offshore around the coast of the United States.

3.1.1 National Marine Fisheries Service (NMFS)

National Marine Fisheries Service is responsible for planning and implementing fishery management conservation programs of the EEZ, including implementation of fishery management plans recommended by the NPFMC. The regional office also coordinates Federal and state resource management and research, monitors harvest, and sets openings and closures in federally managed fisheries. The Alaska Fishery Science Center in Seattle, Washington, along with its research laboratories on Kodiak Island and at Auke Bay, Alaska, plan and conduct fishery research studies to assess stock abundance, collect biological information, and study factors affecting production in the U.S. EEZ off Alaska and in adjoining international and foreign waters.

3.1.2 North Pacific Fishery Management Council (NPFMC)

The Magnuson Act created eight regional fishery management councils. The NPFMC has responsibility for fishery management in the U.S. EEZ off Alaska. This geographic area of authority includes fisheries in the U.S. EEZ of the Arctic Ocean, Bering and Chukchi Seas, and the Pacific Ocean seaward of Alaska, including the Gulf of Alaska. The 15-member council regulates resources through fishery management plans developed with input from Federal, state, industry, environmental, and other interested parties. These plans serve as the base reference documents for management of fisheries within the U.S. EEZ, and contain detailed descriptions of stocks fished, and participation and management goals. Through amendments to these plans, fisheries are structured to meet the changing needs of society. The NPFMC makes management recommendations to the NMFS in the form of amendments that are then approved or rejected by the U.S. Department of Commerce.

The NPFMC also has responsibility for establishing annual harvest levels for target groundfish, for setting the non-target bycatch levels allowed in each fishery, and for recommending a percentage of the pollock total allowable catch (TAC) for Community Development Quotas (CDQ). These recommendations are approved or rejected by the U.S. Department of Commerce. National Marine Fisheries Service is responsible for regulating the U.S. EEZ fisheries to assure compliance with TAC. The State of Alaska allocates CDQ to local communities that file applications. Although crab and other shellfish are covered under the Magnuson Act, the Federal Government has allowed the State of Alaska, through the

Board of Fisheries and the ADF&G, to manage these resources under the Federal fishery management plan.

3.1.3 Alaska Department of Fish and Game (ADF&G)

Alaska Department of Fish and Game is the research, management, and regulatory agency for the State of Alaska. Its activities are regulated by the Board of Fisheries, the policy-making arm of the state government. The Division of Commercial Fisheries, within ADF&G, is charged with research and management of commercial fisheries in Alaska waters (within three nautical miles of shore), and under agreement with the NMFS, crab and shellfish fisheries in the U.S. EEZ. Alaska Department of Fish and Game conducts research similar to that conducted by the NMFS and makes recommendations to the Board of Fisheries for area openings and closings to keep fishing within established harvest guidelines.

3.1.4 International Pacific Halibut Commission (IPHC)

The International Pacific Halibut Commission was established in 1923 by a convention between Canada and the United States for the preservation of Pacific halibut in the North Pacific Ocean and the Bering Sea. Three IPHC commissioners are appointed by the Governor General of Canada and three by the President of the United States. The commissioners appoint a director, who supervises the scientific and administrative staff of the IPHC, located in Seattle, Washington. The IPHC conducts stock assessment surveys, collects biological data, and recommends policy and regulatory actions and harvest guidelines for approval by the two governments.

3.2 Resource Assessment

The following discussion focuses on eastern Bering Sea crab, cod, and halibut harvest because they are the species that would be targeted by small vessels operating out of a new harbor at Saint Paul. The assessment depicts harvests by Saint Paul based vessels as they are anticipated with the project. Saint Paul is the least cost base of operations for a size-constrained fleet. Except for current activity of the existing Saint Paul fleet, the harvest in the without-project condition is by vessels operating out of alternative ports instead of from Saint Paul.

There is a huge amount of data available regarding resource availability and the cyclical nature of the Bering Sea fisheries, especially crab stocks. This summary assessment has relied on published data from the above-described responsible agencies.

Crab stocks and harvest activities are continually monitored. The managing agencies develop guideline harvest levels (GHL), which are designed to promote long-term health of the resource. The stocks are dynamic and tend to be very unpredictable over short time frames. It is therefore acceptable practice to amend the GHL, as needed, to make short-term, and often, short-notice changes in the allowable harvest during the course of a year. On occasion complete closure of a fishery has been continued for as much as 1–3 years to allow stocks to recover. In order to incorporate the cyclical nature of annual harvest data, an average of harvest data over the last ten years was used as an estimate of future harvest activity. The ten-year average, shown in table 2, includes boom years and bust years. It also is recent enough to capture productivity effects of present day capital and technology.

Table 2. 1990–1999 Crab Harvest Data Eastern Bering Sea

(million lb)

Year	Tanner	Pribilof Red/Blue King	St Matthew Red/Blue King
1990	160.0	0	1.7
1991	325.2	0	3.2
1992	313.0	0	2.5
1993	229.2	2.6	3.0
1994	148.0	1.3	3.7
1995	74.0	2.0	3.1
1996	64.4	1.1	3.0
1997	117.1	1.2	4.4
1998	240.0	1.2	2.9
1999	183.4	0	0
TOTAL	**1,854.3**	**9.4**	**27.5**
AVERAGE	185.4	0.9	2.8

Generally, the resource assessments and harvest estimates in this report are based on data for the eastern Bering Sea. Since Saint Paul is centrally located to all of the stocks, a small vessel fleet, operating out of Saint Paul, should enjoy an economic advantage over similar vessels operating from other ports. This report defends the proposition by illustrating that operations out of Saint Paul are a low cost option. Individual Fishing Quota (IFQ) and CDQ are therefore not material factors.

3.2.1 Role of Resource Assessment in the Benefit Analysis

The establishment of a defensible estimated harvest from Saint Paul, under the with-project and without-project, was central to an evaluation of benefits for a new harbor. Overall there is no increased catch, however, the increase in Saint Paul based harvest, under with-project conditions, supported a flow of potential project related gross income to the island, which was used to estimate the number of vessels that could be supported there. The resource assessment was therefore the key to predicting the "with-project fleet." The projected gross harvest by the Saint Paul based fleet is summarized in table 3.

After derivation of the fleet, and the gross income, the benefit analysis was linked to identification of cost differences between harvest operations out of Saint Paul and an alternative port. In order for the cost differences to be estimated, sample vessel operating budgets were developed. The budgets were established for vessels typical of the future fleet and show costs incurred in a typical year. Data from fishers, manufacturers, other reports, and published sources were relied on (see budgets and footnotes). The budgets (see tables 6, 7, 8, and 9) were important to the benefit analysis because they were used to derive the hourly cost of operations. Benefits depend to a certain extent on being able to make the case that a harvest out of Saint Paul will require fewer hours and less travel, hence be less costly. The importance of the budgets is further addressed in the risk and uncertainty portion of this report.

3.2.2 Near-Term Crab Stock Assessment and Harvest

Crab fisheries in the Bering Sea/Aleutian Islands (BSAI) are managed under the Federal Fishery Management Plan (FMP) for Bering Sea/Aleutian Islands, king and tanner crab. This

FMP defers crab fishery management to the State of Alaska, including the setting of guideline harvest levels (GHL). It is typical for GHL to show extreme variations over 1–3 years.

Based on ADF&G near term evaluations and NMFS annual crab assessment, the harvest in the next 1–3 years will be very low. Key dynamics are growth rates, natural mortality rates, allowed harvest rates, and pre-recruitment abundance by size/sex categories. In the near term, GHL will be driven by spawning stock abundance and abundance of young crab expected to grow into legal size (males) and spawning size (females). The GHL are set on an annual basis and sometimes are changed during the course of a year. The nature of the dynamics of the resource and the broad range of uncertainty in assessments requires GHL to be administered as an adaptive management technique. When the dynamics are out of balance, the resource managers act to protect the stocks until they recover. At present, it appears that the ADF&G might put a moratorium on harvest of king crab, possibly for as long as the next three years. It is also highly likely that for the next three years ADF&G will restrict GHL of tanner stocks in the BSAI to under 40 million lb[1]. Average annual harvest during the 1990s was 188 million lb, and the range during the decade was from 64 million to 325 million pounds.

As a means of assuring itself a place in the long-term crab harvest, the community of Saint Paul offered a proposal to the ADF&G Crab Plan Team in 2000 that was designed to maintain community participation in the crab fisheries. This proposal recommended a minimum amount (percentage) of crab to be delivered to specific geographic regions (Pribilofs, Aleutians, and Kodiak) based on historical delivery rates (both floating and shore-based in each area). This proposal suggested qualifying years that go back no further than five years. Historically, over the 1995–1999 period, when large scale processing has been taking place, Saint Paul deliveries have averaged about 35% of the total. Even at the short-term harvest level of 40 million lb, this would result in over 14 million lb delivered at Saint Paul. The smaller vessels based at Saint Paul would be at even a greater economic advantage for the designated Saint Paul delivery.

3.2.3 Long-term Crab Stock Assessment and Harvest

All of the management plans and policies drive toward a long-term sustained yield fishery. In some years there will be large harvests, allowed because of healthy stocks and dynamics. In other years harvests may be restricted to low levels or perhaps not allowed at all. Because of the many uncontrollable variables and the general unpredictability of GHL beyond the 1–3 year time horizon, the long-term assumption is that management will be successful in achieving historic harvest levels of the last decade.

3.2.4 Long-term Small Boat Crab Harvest From Saint Paul With- and Without-Project

Although Saint Paul is practically at the center of the crab fishery, the fleet operates out of other ports. The typical crab harvester is too large to find moorage at Saint Paul in both the with-project and without-project condition. Depending on the year, there are about 10–40 vessels under 60 ft that operate successfully in the Bering Sea crab fishery, but they also must do so from other ports. Generally, the higher the GHL the more the smaller vessels are

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[1] Dr Jerry Reeves, retired NMFS Chief Bering Sea Crab Biologist, in Economic Impact of Bering Sea Crab Stock Disaster on Saint Paul and the Need for Fisheries Diversification in Years 2000 and Beyond, Natural Resources Consultants, 1999.

likely to participate. In harvest years before the huge specialized crabbers were introduced (early 1980s), vessels under 60 ft could compete and were in the fishery in greater numbers. It is vessels in this under 60 ft size class that will realize lower operating cost if based at Saint Paul in the with-project condition. In year 2000, crab fishers under 60 ft made up 215 of the 1,035 active crab harvesters statewide.

The under 60 ft vessels are favored under a new capacity reduction program. A year 2000 Amendment to the Magnuson-Stevens Fishery Conservation and Management Act[2] introduced a capacity reduction program for the BSAI crab fisheries. The amendment seeks to obtain the maximum sustained reduction in fishery capacity, at the least cost, by establishing bidding procedures that allow permits to be relinquished. The procedure sets a bidding structure that favors buying of permits from the larger harvesters first. It also includes provisions that allow vessels up to 60 ft to remain in operation, providing they participate in a repayment fee program. The overall effect will be to reduce the total number of fishers with emphasis on reducing the number of larger size vessels and increasing the amount of harvest by the smaller vessels.

According to Commercial Fisheries Entry Commission (CFEC) data, there are vessels under 60 ft that make up about 2% of the total. The with-project condition allocated the harvest of these smaller vessels to a Saint Paul based fleet on the strength of a demonstrated economic advantage of operating from there. Harvest data indicates these vessels historically account for about 1,340,000 lb per year, valued at $1,430,000. This is considered to be a low-side value because the Limited License Program (LLP) will lead to increased crab harvest by smaller and smaller vessels as the fleet goes through a downsizing, starting in 2001.

Table 3. Average Annual Crab Harvest From The Eastern Bering Sea, 1990–1999

Species	Exvessel Price ($)	Harvest (lb)
Tanner Crab	1.00	185,400,000[3]
Saint Matthew Blue King	2.80	2,750,000[4]
Pribilof Red and Blue King	4.20	940,000[5]
Total Annual Harvest		191,980,000
Saint Paul Island Landings Using 35% Historic[6]		68,100,000
Weighted Average Price	1.05	
Annual Value of Saint Paul Landings	71,500,000	
Value of Landings by Vessels <60 ft	1,430,000	
Portion of Values In CDQ Allocation[7]	1,100,000	
Estimated Potential Local Fleet Harvest	2,530,000	

[2] Amendment to sec 144. (a) (16 UCS 1801 et. Seq.) Excerpted from the Congressional Record–HR 4577, Department of Labor Health, and Human Services and Education and related agencies Appropriation Act 2001 House of Representatives—December 15, 2000. The program is referred to as LLP in this report.

[3] Ten year average during the 1990s

[4] Ten year average during the 1990s

[5] Data includes zero catch during 4 years of closure

[6] From 1995–99 Saint Paul deliveries ranged from 25–42 % of the total EBS harvest

[7] CDQ stands for Community Development Quota. It is an exclusive harvest share allocated to residents of Saint Paul

3.3 Future Cod Harvest

Pacific cod inhabit most of the eastern Bering Sea shelf region and are also found in less abundance in the Aleutian Islands. Pacific cod are most abundant inshore along the north coast of the Alaska Peninsula, around the Pribilof Islands, and north on the outer continental shelf to Saint Matthew Island. Pacific cod concentrate in the deeper water of the outer continental shelf edge for spawning from January to March and migrate into shallower waters on the continental shelf to feed in the summer and fall. Pacific cod enter the fishery at about age four or five and may live up to 12 years.

Pacific cod are targeted by large shore-based and offshore fleets operating bottom and mid-water trawls as well as a long-line catcher/processor vessels, and a smaller jig vessel and pot fleet. The length of the Pacific cod fishery depends mainly on halibut and crab bycatch quota attainment. The fishery begins on January 20, but full participation does not occur until after the pollock "A" season is completed in mid-February. The majority of the Pacific cod harvest occurs in the spring and early summer. The entire fishery is active for 90 to 120 days each year in the EBS/AI. Pacific cod are not allocated between shore-based and at-sea fisheries. Long-line fishermen concentrate their efforts in the vicinity of Saint Paul Island during much of the year.

The total allowable catch (TAC) for Pacific cod in the EBS/AI has varied between 164,500 metric ton (mt) to 250,000 mt in the 1990s. The harvest of Pacific cod varied from 206,000 mt to 167,000 mt during the decade. Pacific cod have been exploited at a rate of between 10% and 26% of available biomass, a very conservative harvest strategy. Pacific cod harvest has been limited by halibut and crab bycatch limits, not the available resource. Saint Paul's harbor is well positioned for the development of cod processing activities. Its proximity to cod and other fisheries resources make it an economically viable activity from the perspective of the fishing industry. The Pribilof area contains 76% of the cod population of the entire eastern Bering Sea.

With the planned introduction of cod processing, the Saint Paul fleet is one step closer to full participation in the cod fishery. The Central Bering Sea Fishermen's Association (CBSFA) has entered into an agreement with American Seafoods to develop a shore-side cod processing operation as early as June 2001. This will be one of the community's most important steps towards a sustainable multi-species economy.

National Marine Fisheries Service action taken this year to protect the endangered Steller Sea Lion[8] has dispersed the existing cod fishery away from critical habitat areas in the Aleutian Chain and the Pribilofs. The Pribilofs are a critical habitat, and some fishing restrictions for cod will apply out to 20 nautical miles (nm). As accommodation for restrictions on harvest activity, the vessel operating scenarios in this report allow for clearing the habitat zone before fishing. Nevertheless, fishing will be concentrated around Saint Paul, and the cod industry is anticipated to seek processing sites that are closer to where the fishing effort will be concentrated, such as Saint Paul.

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[8] Endangered Species Act, Section 7 Consultation, Biological Opinion, and Incidental Take Statement, Authorization of Bering Sea/Aleutian Islands Groundfish Fisheries Based on the Fishery Management Plan for the Bering Sea Aleutian Islands Groundfish; and Authorization of Gulf of Alaska Groundfish Fisheries Based on the Fishery Management Plan for Groundfish in the Gulf Of Alaska, NMFS, November 20,2000.

3.3.1 Infrastructure Development for Cod Processing

Saint Paul is working with the Department of Commerce, Alaska's Congressional Delegation, and the State of Alaska to ensure that Federal assistance will be directed at several infrastructure projects to support diversification, including the development of new cod harvesting and processing capacity.

Central Bering Sea Fishermen's Association has entered into a Multi-Species Development (MSD) agreement with American Seafoods, which will accelerate Saint Paul's entry into multi-species processing. The agreement will result in deployment of a state-of-the-art catcher processor to Saint Paul to operate inside the harbor as a shore-based processing platform. The vessel has a fishmeal plant, which will allow Saint Paul to commence new processing activities several years sooner than permitting and construction of new facilities would allow for. The investment and operating cost are self-liquidating through royalty arrangements in the agreement.

The City, CBSFA, and other entities are working together to try to accelerate the construction of the small boat harbor and the development of new programs that will allow the local fleet to fully participate in the cod fishery as soon as practical.

3.3.2 Cod Opportunity within Existing Allocations Framework

Within the existing framework, cod processing capabilities can be developed to supplement dependence on crab, halibut, and other species. Now 80% of the cod TAC goes to the freezer longliners, 18.3% to the pot codders, and 1.4% to pot and longline vessels less than 60 ft long, which are exempted from the cod LLP. Within the three-mile state waters, however, the LLP and the split do not apply. There is an opportunity within this framework to develop a local cod fishery and cod processing activities on the island as early as 2001.

The framework plan includes the following elements:

<u>Accommodation of a Pribilof critical habitat zone</u>. The limitations will not interfere with the gross income potential of cod longliners. This is because of temporal dispersal of effort throughout January 20–October 31, with closure between November 1 and January 19. The rookeries are already no fishing zones.

<u>Access for local fishermen to the 1.4% allocation for pot and longline vessels less than 60 ft long.</u> By tapping into the 1.4% and the cod located within the proposed Pribilof Cod Fishery Zone, Saint Paul could begin to develop a small vessel cod fishery that coincides temporally with the CDQ halibut fishery. Also, that part of the overall harvest by the cod fleet under 60 ft (a large portion of the fleet is under 60 ft but does not restrict itself to small vessel quotas) will have an economic advantage if operated from Saint Paul.

Planned delivery of cod to Saint Paul, with a focus on the production of high quality value-added fillets. This product will maximize revenues and minimize water requirements.

Use of the community investment in the modern harvesters, F/V Ocean Cape and the F/V Zolotoi, for harvest of CDQ cod allocations. These specialized vessels will fish further from the island than the small vessel fleet. Their larger capacity will provide the quantities necessary to keep a processor operating above the break-even level.

3.3.3 Saint Paul Cod Harvest Projection Under With- and Without-Project Condition

The December 1999 stock assessment prepared by National Resource Consultants (NRC) indicated allowable biological catch (ABC) for eastern Bering Sea cod over the past 20 years has been 140,000–240,000 metric tons. With this as a baseline 200,000 mt is the assumed long-run ABC for purposes of this report. The applicable Commercial Fisheries Entry Commission (CFEC) database for year 2000 shows 1,717 longline, jig, and pot permits, for vessels under 60 feet. With a harbor at Saint Paul providing year-round moorage for 60 vessels, about 3.5% of the total fleet under 60 ft would be based there. We have estimated 3.5% of the harvest of Pacific cod would be by vessels from Saint Paul, an annual harvest of 7,000 metric tons. For vessels under 60 ft the cod harvest in the eastern Bering Sea has been increasing steadily . For example in 1996, 1997, 1998, and 1999, the average lb harvested by vessels under 60 ft were 204,000, 151,800, 127,500, and 87,500. The take per vessel has been increasing at a rate of 20–50% per year. Although the data for year 2000 is not available at the time of this writing, it is expected to show a per vessel harvest of over 240,000 pounds. This is consistent with our 7,000 mt estimate for the 60 vessels in the with-project fleet. At an exvessel value of $.45 lb (average price in the 1999 and 2000 west coast market), the total annual value of harvest taken by the Saint Paul fleet will be $6,930,000. In the without-project condition, the harvest will be by vessels operating out of Dutch Harbor.

3.4 Halibut Harvest Opportunities Under With- and Without-Project Condition

The year 2001 Individual Fishing Quota[9] (IFQ) halibut quota (Area 4c) was 1,015,000 lb, but it is distributed among permit holders home ported outside of Saint Paul. In 2001, the Saint Paul fleet's halibut quota included 1,015,000 lb of CDQ, which gave Saint Paul exclusive rights to these stocks. The annual average halibut landings at Saint Paul during the last three years has been 100% of the 3-year average CDQ. Activity by the local fleet accounted for all of the CDQ halibut landings.

With the project, it is anticipated that the economic advantage of the location of Saint Paul will result in half the area IFQ being harvested by vessels home ported at Saint Paul. Over half of the Area 4 halibut fleet will be based at Saint Paul in the with-project condition. These vessels will arrive with IFQ. In addition, CBSFA is actively seeking IFQ for the local fleet. With reliance on IFQ, there will be an increase in average annual landings at Saint Paul of at least 508,000 pounds. At exvessel prices of $2.00 per lb, this will yield an estimated increased gross long-term average annual income of the local fleet of $1,016,000. Without the project, the balance of the area harvest would be by vessels continuing to operate out of Dutch Harbor with some incidental participation by vessels possibly from King Cove, Sandpoint, and False Pass.

[9] IFQ is individual fishing quota

4.0 FLEET DEVELOPMENT UNDER WITH-PROJECT CONDITION

4.1 Operating Profile of the Saint Paul Fleet

A fleet projection was derived by determining the gross harvest income that would be captured by a Saint Paul based fleet and calculated the number of vessels that this income would support. The vessel operating data that was used to arrive at a relation between gross income and net income to the owner was publicly available through the University of Alaska (U of A)[10], and was gathered from studies of the halibut fleet before establishment of the IFQ. This was used because the halibut fleet is the largest of all and therefore provides a huge data sample. The U of A data was compared against information in the 1989 Alaska Seafood Industry Study[11] and found it to fall near the middle of the range of a skipper's pay percentage for non-salmon vessels under 50 feet. The U of A data is also attractive as a data source, because over 80% of the vessels in the halibut fishery are under 55 ft, and most of them are involved in multiple fisheries. The operating profile of this fleet is more like the future Saint Paul fleet than any other data identified during the study. Based on the U of A data, exvessel values were sorted out as follows:

Table 4. Exvessel Values of Saint Paul Fleet

Operating Expense = 24%	This includes fuel, gear, bait, food, and special payments to hired captains and vessel owners.
Crew Share = 49%	This includes crew payments net of expenses shared by the crew.
Operators Share = 27%	This includes fixed cost such as license, insurance, moorage, maintenance, and vessel payments.
Net Operators Share = 12%[12]	This excludes deductions for fixed costs estimated at 15%. Using the above 12% as a basis for estimating operators income, the fleet based at Saint Paul will provide a total net operators share of $1,308,000.

4.1.1 New Operators

A growing fleet at Saint Paul would actually result primarily from relocation of existing vessels from other locations. The vessels would be relocated to Saint Paul under existing owners or new owners. There is economic support for the idea that new owners would develop out of the Saint Paul population. The community has a strategy for emphasizing marine related economic development and capital for vessel financing is available.

At Saint Paul, the average income per working person, based on 1999 Department of Community Development data was $18,100. For new owners, it was assumed, the income from fishing must exceed the average earned non-fishing income by a significant level to induce people into the fishery. Most of the historical experience with fishing has been for subsistence purposes rather than commercial enterprises, and there are other employment

[10] Alaska Review of Social and Economic Conditions Vol. XXIX, No 2.

[11] Alaska Seafood Industry Study, Appendix A, The McDowell Group, Juneau Alaska, 1989.

[12] 12% is most typical of the Saint Paul fleet which is made up of multiple purpose vessels less than 58 ft which operate as longline or pot harvesters. Radtke and Davis in State and Coastal Communities Economic Assessment Project Contribution From Distant Water Fisheries to Oregon's Economy in 1996, Oregon Coastal Zone Management Association, Oregon Department of Fish and Wildlife, Oregon Economic Development Department, Oregon Sea Grant Program, January 1999, Radtke and Davis, The Research group, Corvallis Oregon., show net income of the Alaska longline and pot harvesters that deliver to shore-based plants at 18%. The fleet in Radtke and Davis is not size constrained.

opportunities available. Even with capital available[13] for financing new owners of vessels, permits, and gear, there must be adequate profit to induce them to undertake the lifestyle change and associated risk.

There is no certainty of the income level that would provide an adequate incentive to induce development of a local fleet. Therefore, two threshold levels have been set above the average income, and high enough to present entry into fishing as among the better opportunities on the island. The threshold levels for entry are 120%, and 140% of the community average earned income. The average earned income is $18,100, and the rounded threshold income levels are $21,700 and $25,600 respectively. The expanded fleet will increase landings by local fishermen by about $10,900,000 annually as shown in table 5.

Saint Paul residents have an unusual history. Even though they have lived on an isolated island, they have not had the opportunity to learn about the fishing industry and participate in it, except for the last few years. New developments in the fishery for halibut and other species are getting the attention of the island residents, and they are beginning to position themselves to take advantage of career opportunities. They are well aware of the risks involved and are sensitive to the fact that fishing must present itself as an attractive economic opportunity for them to be induced into major life style changes. Based on an increase in landings by the Saint Paul fleet of $10,900,000, a net operators share of 12%, and threshold income levels of $21,700 and $25,600, the number of vessels that will be added to the local fleet will be a low of 50 and a high of 60.[14]

The vessels will range in size up to 58 ft, and their gross income during the year will range from zero (small vessel subsistence fishers) to over $413,000 for the 58 ft vessels. The net share of the operator will range from zero to $50,000. These threshold levels represent averages for the fleet.

4.2 Fleet Size Distribution

Given that a with-project condition could support a fleet of up to 60 vessels, a fleet configuration was needed. Vessel sizes were distributed to mirror the make up of Alaska's multi-species fleet. To do this we used the fleet most typical of the multi-species fishers, which was the registered halibut fleet before the IFQ effects of 1995. At that time entry to the fishery was unlimited, and all of the vessels in that fleet were also employed in other fisheries. Therefore, the size distribution of the halibut fleet was used to distribute Saint Paul harvest by vessel size with one modification. The modification was dictated by the nature of the crab harvest because in the Saint Paul fleet only the largest vessels are practical as crab harvesters. In order to handle the necessary equipment and operate at a scale that is profitable, minimum crab vessel size is at the upper limit of the Saint Paul fleet. Therefore, crab harvest was allocated to the vessel size class above 55 feet.

[13] CBSFA has funded a revolving fund for financing purchases by CBSFA members.

[14] Among Alaska commercial fishing permits issued in 2002 about 55% of them were actually employed in the harvest. It follows that this very large pool of inactive vessels will provide a resource for the risk taking profit seekers that will become new operators out of St Paul.

Table 5. Distribution of Harvest by Vessel Size Class Under the With-Project Condition

Class (ft)	Crab ($)	Cod ($)	Halibut ($)	Subsistence ($)	Harvest Total ($)	No. Vessels
0–26	0	970,000	142,200	399,600[15]	1,516,800	28[16]
26–39	0	2,772,000	406,400	0	3,178,400	14–17
40–55	0	2,079,000	304,800	0	2,383,800	11–13
55+	2,530,000	1,108,800	162,600	0	3,801,000	17–22
Total	2,530,000	6,930,000	1,016,000	399,600	10,900,000	70–80
Moor age Demand without Trailerable Vessels						**50–60**

4.2.1 Advantages of the 40–58 Foot Class

Vessels as small as 40 ft could be marginally practical for the near island crab harvest. Vessels under 60 ft are restricted to 40 pots for king crab. No matter how much larger the vessels are, only ten additional pots are allowed. The main constraint on size will be the smallest vessel, which can efficiently and safely fish an adequate number of pots to break even. According to a consensus arrived at in a meeting with fifteen local fishermen, vessels in the 40 ft to 58-ft class are practical, and 58 ft are ideal. Capability of vessels in this class to fish commercial pots was verified with west coast vessel facilities.

The 58 ft vessels are also in great demand, because of salmon fishing profits and rules, which establish this as the maximum size vessel allowed in some salmon fisheries. Demand for the 58 ft size is so strong that, in many cases, larger size vessels have been selling at lower prices. A balancing force is that the success of fish farms is driving salmon prices down, and these vessels are no longer as desirable as they once were for exclusive salmon fishing. Some of the formerly exclusive salmon vessels are being outfitted for multi-use fisheries. The newly constructed 58 ft vessels are designed to perform in a multi-use fishery.

Vessels larger than 58 ft may be cheaper to buy but would require a deeper harbor, and depth is a major local concern influencing planning of the harbor. In addition, the larger vessels would require more dock space and more substantial moorage facilities. This fleet projection is based on concerns for overall cost minimization while maximizing efficiency of the fishery. It is anticipated that vessels may vary from the ideal 58 ft size. Buyers may be able to save 10%–20% by shopping in the sizes closer to 55 ft and 68 feet. The 68 ft vessels will not be able to use the harbor when fully loaded, but the 55 ft vessels will, and they may perform nearly as cost effectively as the 58 ft vessels. It is therefore expected the multi-use fleet, which will primarily target near shore crab stocks, will be in the 55 ft to 58 ft range, and the maximum draft will be 8 feet.

[15] Evaluated at an equivalent market price based on substitute values. Includes only the project related harvest increase.

[16] The allocated harvest justifies 8 vessels based on the income threshold. An estimated 20 local skiffs were included in this class. All are trailered or carried and are anticipated to be users of the launch ramp.

5.0 FLEET DEVELOPMENT UNDER WITHOUT-PROJECT CONDITION

The local economy and the harbor will not undergo significant changes without the project. The strategy of the community, to develop a multi-species harvest and processing complex, will not be economically viable without a small boat harbor. Therefore, there are few changes expected for the local fleet in the without-project condition. The existing CBSFA fleet of 26 vessels, all under 32 ft plus about 20 skiffs used for occasional subsistence harvest, will remain in use.

5.1 Operating Scenario

Under the without-project condition, most of the harvest of the resource around the island will be by vessels operating out of Dutch Harbor and delivering there. It is the closest alternative port with processing and moorage facilities available. The smaller sized vessels that are kept at Saint Paul are too small to harvest crabs efficiently and safely. From Dutch Harbor, a run of between 215 and 340 miles is necessary to reach concentrations of the main crab stocks of the eastern Bering Sea fishing grounds. This is generally a radius of 65 miles around Saint Paul Island. This open water trip from Dutch Harbor and other ports has increased risk for vessels under 58 feet.

The 58 ft vessels operating out of Dutch Harbor will use a three day trip out of which about 30 hours will be spent fishing compared to the 6-hour fishing periods for day trips out of Saint Paul. This allows harvesting to the maximum potential of vessel capacity and is the most economical mode of operation under the with- and without-project condition.

The operating scenarios, under the with- and without-project condition, would differ in that with the project, the vessels are anticipated to be actively involved in the fishery on every day when the weather is suitable for 58 ft vessels. In the without-project condition, there are more vessel days restricted by weather because there are many smaller vessels in the fleet. Also there are adjustments necessary due to local customs, and the nature of a developing infrastructure. Taken together, these factors give the Dutch Harbor vessels an advantage in terms of catch per harvest day. As a result of the higher harvest rate and larger vessels, fewer vessels are needed to conduct the harvest in the without-project condition. This advantage is somewhat offset by the increased travel time to and from Dutch Harbor.

All harvest activity regardless of specie is tightly controlled by restrictions on time and place of harvest. Harvest season varies from year to year. For example, in 2000 there was a complete closure of tanner crab fishing, but the snow crab season lasted 67 days and resulted in a taking of almost 184 million pounds. In contrast to this, the 2000 snow crab season lasted 8 days. For 2001, the snow crab guideline harvest level is set at 27.3 million pounds. This harvest level could be reached in 8 days or less.

Without all of these temporal constraints and given a fixed Guideline Harvest Level (GHL) at the ten year average, it would be theoretically possible to conduct the entire harvest of crab stocks that would otherwise be harvested from Saint Paul, by operating only four vessels out of Dutch Harbor. At the other extreme, given a fixed GHL, if there were to be a 20-day active crab harvest, 38 vessels would be needed. Our example of a 20-day season is based on a cycle of two 30-day seasons followed by a year of closure and is purely hypothetical. Fleet availability is not a concern as there are 38 vessels under 60 ft, which could be available from the 295 under 60 ft that currently occupy moorage at Dutch Harbor, Sandpoint, and King Cove.

The vessels are theoretically “available,” because all of them enjoy the prospect of generating a higher gross income by harvesting crabs near Saint Paul if they are one of 38 vessels doing so. The average gross income would be over $65,000 for a 30-day harvest. In 1998 there were 38 Aleutian Island vessels under 60 ft that had smaller gross income in other fisheries. This was verified by reviewing the CFEC income summaries available by quartile for the Aleutian Island fishers. Since salmon seiners are under 58 ft, the salmon seine income records were a reasonable representation of income for the BSAI fleet under 60 feet.

5.2 Vessel Description

Regardless of the number of vessels needed, it was assumed all of them would be 58 ft, however, half would be a heavier version with a capacity of 90,000 pounds. Vessels under 58 ft are unacceptable due to sea conditions and over 60 ft introduces significant regulatory restrictions. They would be 58 ft by 23 ft by 9 ft, and be rated at about 1,700 hp, having capacity to operate as mid-water trawlers. They would have on-board processors and freezers. The other half would be more conventional sized “limit seiner” combination vessel with a capacity of 60,000 pounds. They would be 58 ft by 17 ft by 8 ft, and would be rated at 420–870 horsepower. For all of them, the hold capacity was reduced by half to allow for ice, salt, and/or refrigeration needed to preserve the catch for the 30 hours of fishing, plus more than 20 hours of travel before offloading at Dutch Harbor. Offloading and preparation times were included in travel. The capacity adjustment also allows for trips that are cancelled or cut short by mechanical problems, weather, low success rate, and crew needs.

After hourly costs were established for particular vessel types, they became a constant although the fleet size would vary depending on number of open season days allowed for the harvest. It does not matter how many vessels are required, because the number of vessel hours needed for the harvest is the same regardless. The sensitivity of benefits to variations in fleet size was limited by keeping total vessel operating hours constant regardless of number of vessels in the fleet.

In our calculation of hourly cost, the number of days fished was adjusted for unacceptable sea conditions 35% of the time. Because the vessels are large, lay up for minor repairs, gear change, crew rotation, and maintenance was limited to 60 days. Ten days were allowed for shut down at the holiday season. Within this criteria there would be a total of 222 round trips, and each round trip would require about 43 more hours of travel time to and from Dutch Harbor than daily trips in and out of Saint Paul.

Using the hourly vessel operating budgets generated for this report at $134.30 and $56.80, the travel cost under the without-project condition is $635,200 for the 19 larger vessels and $268,600 for the 19 smaller vessels, for a total of $903,800.

6.0 VESSEL OPERATING BUDGETS

6.1 Vessel Characteristics and Performance Criteria

Data regarding the characteristics of the fleet was gathered in meetings with members of the Central Bering Sea Fishermen's Association (CBSFA) in the summer and fall of 2000. The membership was unanimous that, under the with-project condition, the day fishery fleet will exploit the fishery within a 1–3 hour daily run from Saint Paul. The area immediately adjacent to Saint Paul and out to 65 miles from the island is reported to support 65% of the Bering Sea commercial fishing activity.

The Bering Sea conditions generally require stout vessels, however the maximum size of the future Saint Paul fleet as determined by the local fishermen's association is 58 feet. These sized vessels offer a scale of operation that is profitable for the day fleet, and they also happen to be the maximum size allowed for salmon harvest. There is no commercial salmon fishery at Saint Paul, but the multi-use potential adds to the vessel resale value. Resale value is a major concern to the local fishermen, because they will be going through a transitional phase of fleet development by increasing the size of vessels. Vessels under 60 ft do not require observers thus saving at least $20,000 in annual operating cost, and they are in the size range eligible for increased crab harvest opportunities under the new LLP criteria.

Vessels near the limit of the 58 ft class that are designed for use in Alaska waters are generally wider, deeper, and more powerful than vessels designed for use elsewhere. This adds to the versatility of use as harvesters of cod, halibut, and crab. There are 58 ft vessels in operation that are up to 29 ft wide. One, mid-sized 58 ft vessel discussed, had overall dimensions of 58 ft by 23 ft by 9 ft with about 1,700 horsepower. Though not the largest in operation, it was regarded as being the maximum size of any fleet addition at Saint Paul. Vessels typically sized at 58 ft by 17 ft by 7 ft are substantially less costly and in a day fishery can do everything that the larger vessel can do with the exception of mid-water trawling and will be the most common.

Vessels need to be large enough to operate in a wide range of sea conditions with the versatility of effectively harvesting with longline and pot gear. They should be able to operate at their maximum level of efficiency with a crew of 3–5 persons. A preference was expressed for welded aluminum construction, diesel power, fast running speed in all sea conditions, a clear deck area from the rear of the deckhouse to the stern, and readily accessible fish storage.

6.2 Operating Days

The number of operating days is important to establishing an operating budget. At Saint Paul the number of operating days varies by vessel size. Some of the smaller vessels will be used for subsistence use only during fair weather periods and others will only be used occasionally for harvest of CDQ allocations. Either way the annual harvest of these smaller craft can be completed well inside of 90 days.

For any vessel under 58 ft operating out of Saint Paul, the operating scenario allowed for a 120 day winter lay up period, subject to ice and sea conditions, is generally unacceptable for small vessel operations. In addition to the winter closure, possible fishing days were reduced by adjusting for the annual frequency of exceedence of limiting waves. In this report a "limiting wave" is defined as being a non-breaking wave equivalent in height to 10% to 25% of vessel length. According to CBSFA fishers, it is a limiting wave in terms of comfort and safety of the crew working a longline operation on an open deck. For this report deepwater wave data was used, and the informed judgment was made that a limiting wave exceedence frequency corresponded to an annual deepwater wave height at the lower end of the 10%–25 % of vessel overall length. On an annual basis critical waves would close down harvest operations 70%, 40%, and 35% of the time for 32 ft, 45 ft, and 58 ft vessels respectively. Number of potential operating days would be 73, 147, and 159 respectively.

Of the total potential operating days, about 30% are actually fished. Some vessels go out every day, but others sit out most, if not all, of the commercial season. Observations of harvest activity during a period when halibut CDQ and IFQ were available and weather conditions were good indicated about a third of the vessels were active on a daily basis. There are many reasons for the entire fleet not fishing every day. Among the reasons that will be factors for the without- and with-project conditions are crew availability and vessel breakdown. Crew availability is a factor because some of the crew and owners are active on other vessels at other locations during certain seasons. This is anticipated to be a normal long-term part of life at Saint Paul. There are limited employment opportunities on the island and many people seek work elsewhere for part of the year. Vessels can be out of service for long periods due to breakdown because of difficulty in getting parts and repairs at Saint Paul.

From operating scenarios developed, during interviews and public meeting participation with CBSFA fishermen at Saint Paul in 2000, a typical day requires a three-hour run to the grounds at a high power setting, six hours of fishing at minimum power, and a high power run back. An additional 1–4 hours is spent in preparation and unloading with the main engine shut down. Daily harvest was generally less than vessel capacity. This was due to the fact fishing trips were short and that vessel trip limits apply to the CDQ halibut fishery. Details in support of estimated budgets are included as table footnotes.

Table 6. Typical Expanded Saint Paul Fleet Day Fishery[17]

Description[18]	Seine/trawl/crab	Seine/longline/crab	Seine/longline	Longline
	58 ft	58 ft	45 ft	32 ft
Investment ($)	900,000	321,000	135,000	62,000
Length by Beam	58 by 23	58 by 19	45 by 17	32 by 13
Draft feet.	9	8	6	4
Fish hold (lb)	90,000	60,000	30,000	12,000
Main Power	Triple Cat 3176[19]	Twin 3208 Cat	Twin 3208 Cat	Single Cat 3208

[17] Day fishery will be a fleet that can fully exploit the fishery within a daily run from Saint Paul. The Bering Sea conditions require stout vessels, however the maximum size based on input form the local fishermen's association is 58 ft. This is because the vessels are the maximum size allowed to fish for salmon and multi-use potential adds to the vessel resale value.

[18] This choice of "typical vessels" is based on actual vessels in service in the area adjacent to the Pribilof Islands and in the fisheries to be targeted in the with-project condition. Characteristics were gleaned from 200 sample sales listings in 2000. The vessels used to depict operating budgets are near the center of the size range distributions used in the fleet projection.

[19] Based on manufacturers data for a vessel constructed in 1997. Other designs trade off main power needed for trawling for increased auxiliary power. A 2000 design uses less main power but incorporates freezers and processors supported by one 1320-kW Cat 3406, one 190-kW Cat 3306, and a 105-kW Cat 3304. Total hourly fuel use is equal for both designs. This vessel was used in scenarios of the without-project condition.

Table 7. Operating Data Typical Expanded Saint Paul Fleet Day Fishery

	Seine/trawl/crab (58 ft)	Seine/longline/crab (58 ft)	Seine/longline (45 ft)	Longline (32 ft)
H.P.	1710–1980	420–870	420–870	210–435
Fuel use[20]	69–96 gph, 82 avg.	24–48 gph, 36 avg.	24–48 gph, 36 avg.	12–24 gph, 18 avg.
Crew	5	4	4	3
Number of 12-hr fishing days[21] with 6 hrs at max hp and 6 hrs at min[22]	159	159	147	73

Table 8. Typical Operating Budgets Expanded Saint Paul Fleet

	Seine/trawl/crab (58 ft)	Seine/longline/crab (58 ft)	Seine/longline (45 ft)	Longline (32 ft)
Repair/maintenance[23] ($)	90,000	32,000	13,500	6,400
Hull Insurance @ 5% ($)	45,000	16,000	6,700	3,000
P&I Insurance @ 2% ($)	18,000	6,400	2,700	1,200
License/permit fees[24] ($)	47,200	18,300	9,000	5,400
Association dues ($)	1,000	1,000	500	300
Business expenses[25] ($)	18,000	7,000	2,600	1,200
Food[26] ($)	16,400	13,000	11,800	4,400
Fuel ($)	209,800	92,100	82,600	20,500
Return on capital ($)	59,200	21,000	8,900	4,200
Crew share[27] ($)	504,600	206,800	138,300	46,600
TOTAL	**1,009,200**	**413,600**	**276,600**	**93,200**

[20] From Caterpillar technical services library for Marine Applications.

[21] Number of days allows for a 120 day winter period subject to ice and sea conditions unacceptable for small boat operations at Saint Paul. Fishing days have been reduced by the annual frequency of exceedence of limiting waves. Height of a limiting wave for small boat longline operations is generally 10% to 25% of vessel length. Limiting wave exceedence frequency is based on annual deepwater events exceeding 10% of vessel length. About 30% of potential days are actually used for harvest.

[22] From operating scenarios developed during interviews and public meeting participation with CBSFA fishermen at Saint Paul in 2000. A typical day requires a three hour run to the grounds at maximum power, six hours of fishing at minimum power, a maximum power run back. An additional 1–4 hours is possible in preparation and unloading with the engine shut down.

[23] Annual vessel, machinery, and maintenance estimated at 10% of vessel value as a range midpoint. Includes an allowance for the hourly equivalent of overhaul cost and routine maintenance (lube, oil, filters etc.). A study of Alaska fishers, by The Research Group in 1999 tabulated a range of 8%–20% depending on vessel type. Longline and pot fishers were near the low end of the range and they are more typical of the Saint Paul fleet. Alaska District Cost Engineering Branch estimates for the False Pass report in 2000 show the annual cost at 11% of vessel value.

[24] Using $2,200 as an average of <100 ft pot and trawl vessels, it was prorated by length of the harvest activity. An amount equal to 5% of vessel value was added to allow for IFQ end of season fees at 3% of gross harvest. Data from Study and Houston et al in 1997 indicates license and fees range from 2%–5% of annual gross harvest.

[25] 2% of capital investment. Includes tax filing and tax accounting, business income and expense record keeping, payroll and personnel management, contract negotiation, legal review, account and credit management, travel and entertainment.

[26] Anecdotal based on at site conversations with fishers in 1998 and 1999 estimating dollar expenditures for a season. Also see Radtke and Davis, table 8. Percentages averaged across five fisheries and presented as a percentage of total costs range from 2% to 3% depending on type of vessel. Type of vessel determines size of crew and length of time at sea. In contrast, the Alaska District Cost Engineering Branch estimated crew support cost at $20 per person per day for seine and net vessels working the False Pass fishery in 2000.

[27] Alaska Review of Social and Economic Conditions University of Alaska, Institute of Social and Economic Research, Nov 1994, Vol. XXIX, No 2, Fig 14 page 9 showing halibut fleet operating expenses are 17% of exvessel value, and crew shares are 49%. Figure 26 page 14 shows sablefish ex vessel value divided 54% to crew shares and 6% to operating expenses. Crew shares calculate out to an hourly equivalent of $35, $24, and $26. This contrasts with the Fleet Survey in 1997, which reported a documented average hourly earning of $44. Pacific States marine Fisheries Commission analysis of Dept of Labor statistics for covered earnings shows average earnings per employee in all fisheries related industries (assuming a 160 hour month) ranged from $12 to $20 in 1999. 50% was used for the budgets and later had to reduce that to 20% to show the entire fleet could be profitable. The Alaska Seafood Industry Study explains crew shares in the 20% range for smaller vessels. At 20% average annual earning per crew person was $25,600, average per hour was $32.50.

Table 9. Hourly Equivalent Summary

	Seine/trawl/crab (58 ft)	Seine/longline/crab (58 ft)	Seine/longline (45 ft)	Longline (32 ft)
Fuel cost (%)	21	22	30	22
Hourly fuel cost[28] ($)	106.50	47.00	47.00	23.60
Hourly fuel+repair+maintenance ($)	134.30	56.80	53.50	32.50
Combined hourly variable[29] ($)	26	27	34	30
Total hourly cost ($)	**512.80**	**210.20**	**156.80**	**106.40**

[28] Fuel use at $1.30 is based on survey of actual sales at Saint Paul and Dutch Harbor on consecutive Tuesdays during a 20 month period of 1999 and 2000.

[29] Total hourly operating cost ranges from 26% to 34% of the total cost compared to 31% after price level adjustments to Radtke and Davis.

7.0 WITHOUT-PROJECT CONDITION

7.1 Harbor Problems

The community is aggressively pursuing opportunities to develop a local fleet. Even though Saint Paul is centrally located with regard to the fisheries, the community will not be able to use the advantage without some modification to small vessel facilities. Saint Paul's remote location is the factor that gives the community a location advantage for harvest of certain fish stocks. The existing fleet is without a permanent moorage area, and there are no permanent docks to tie up to. Crowding results in damages to vessels and lost time to operators. Vessels are stored on trailers or cradles in busy areas, tying up land needed for highly valued marine services, given that there is limited commercial and industrial land available on the island. Because most of the island is preserved as open space for wildlife use, lease value per acre of commercial/industrial harbor land offered is as high as $392,000 per acre per year. Damage, theft, and vandalism are common problems at the insecure storage areas.

7.2 Fleet Restrictions

The limitation on vessel sizes, caused by lack of moorage, has caused development of multi-species harvesting to be discouraged. Larger vessels are needed to profitably target cod, halibut, and crab. Since the fisheries occur over an eight to nine month period, vessels over 32 ft are more likely to be compatible with weather conditions. A desire to capture the advantage of developing a multi-species fishery has caused future users of a new small boat harbor to urge the harbor to be planned in a way that will accommodate vessels up to 58 feet. The fishers also desire to maximize the number of days that the fleet can be left in the water, and there are hopes that a year-round harbor will be possible at Saint Paul. They maintain that, without a protected moorage facility, they will be unable to compete, and stocks available adjacent to the island, will be harvested by vessels operating out of other ports.

7.3 Boat Launch And Retrieval

Vessels are often damaged during launch and retrieval. Launching of vessels is a confused, crowded, and risky activity. Because there is no ramp usable by local vehicles, launching is with a crane, and on occasion, with a large wheeled loader. Until 1999, Tanadgusix Corporation (TDX) owned an operational crane and had established rates for the crane at $280 per hour, and $60 per hour for the operator = $340 total per hour. The minimum charge is four hours. In 1999 the TDX crane was damaged in operation and has been inoperable since. As a substitute, the fishermen have been able to use a crane that had been brought to the island to work on the breakwater. When any crane is used to lift vessels, it is necessary to provide an operator and a spotter. Based on a maximum daily rate for the crane, limited to $1967 (TDX rate), an operator at $60 per hour (TDX rate), and volunteer vessel crewman for a spotter, a 24-hour equivalent would be $142 an hour, not including overtime. In this report, the short-term total hourly cost of using the equipment has been adjusted down to $240 from $340. There are expected to be many events where a haul out of the fleet takes place over a period of time longer than four hours but less than 24 hours. The midpoint between the hourly rate and hourly equivalent of the 24-hour rate is $240 per hour, used as an estimate for the use of any crane.

Use of the loader is ordinarily avoided by the fishermen, because the ramp and channel at the put-in point is narrow. During the launch, the rock shoals are difficult to avoid even when the tide is not running and winds are light. Each year several out drives are damaged, and at least one vessel has been sunk. The launching and retrieval frequently demand the attention of six people for a single vessel.

A new haul-out arrangement is needed to handle larger vessels. This could include a hydraulic trailer-tractor combination and an improved ramp. A large mobile unit would be the least cost method of haul out. A new launch ramp could be included as part of the project. The ramp and hydraulic trailer will be practical support for a vessel repair facility that the community needs very badly. Without proper haul-out and transport equipment, development of a needed vessel repair facility is impractical. Lack of a small boat harbor places constraints on more intensive use of some highly valued industrial/commercial waterfront.

Fishermen attempt to maximize use of short, fair-weather periods, and when the weather changes, there is a rush to put vessels in and to take vessels out of the water. If the crane is busy on other work, the wait causes extensive lost time, and vessels in the water are often bumped together and blown aground. Conditions inside the outer breakwater are often so bad that the harbor is closed to vessels of any size, and even vessels over 100 ft are ordered to leave.

At present the only choice open to vessel operators is to leave the harbor when storms arrive, or have the vessel hauled out and put on a cradle or trailer in dry storage. Under present conditions, Saint Paul cannot be used as a place for vessels of any size to seek refuge from storms. Vessels have sunk in the harbor and just outside of it.

7.4 Transportation Cost For Vessel Repair

Saint Paul does not have adequate moorage, haul-out facilities, crane capacity, or a dockside work area for repair crews to fix larger vessels. Because of limited tie-up space, lack of protection against wave activity, and lack of a haul-out facility, vessels in the over 32 ft class, which are in need of repair, must be towed to Dutch Harbor. A sample of 1680 vessels of all sizes calling at Saint Paul in 1999 revealed 56 visits for the purpose of maintenance, repair, and parts replacement. A sample of harbor records indicates that each year there are 5–10 damaged or disabled vessels that must risk the open water trip to Dutch Harbor for repairs not available at Saint Paul. Frequently the vessels must be taken in tow for the entire trip. Vessels have sunk on the way to Dutch Harbor, because it was not possible for them to be repaired at Saint Paul.

7.5 Local Dock Cost

When storm conditions cause wave activity inside the harbor, floating docks for the small vessel fleet are required to be removed. The crane lifts the three approximately 60 ft units from the water and stores them alongside the waterfront at a documented cost per event of $30,000, not including the opportunity cost associated with storage of the dock units on valuable industrial land. The docks had an overall useful life of five years when they were new. By project year one they will be due for replacement at a cost of over $215,000.

7.6 Lost Time

Lack of a protected moorage translates to less fishing time. Operators must use valuable weather windows for launching and retrieval. Fishing for subsistence and for commercial purposes is interrupted, and to a great extent limited. Because of the need to wait on availability of a crane or loader and because everyone rushes to launch and retrieve within a limiting weather window, each launch can take two hours to mobilize the crane and 45 minutes for each vessel. In many instances the lift of one vessel has taken more than two hours. For the fleet under the without-project condition, the total time per launch or retrieval of all vessels is estimated to be 36 to 39 hours. In addition, it takes three hours to move the vessel into storage and secure it. Excluding waiting time between arrival at the haul-out point and beginning of actual haul out, each vessel ties up two or three crew persons.

Under the without-project condition, the vessels will be subject to storm damage if left in the water, hence when one needs to be removed for protection against damage, it is likely all of the others will as well. Average waiting time to beginning of haul out for a specific vessel is estimated at half the expected total fleet haul-out time of 36 to 39 hours, or 18 to 19 hours. During this waiting period the entire crew of each vessel that cannot be trailer launched and retrieved is tied up waiting for crane service, a total loss of an additional 972–1,064 person hours (18–19 hours x 27–28 vessels x 2 crew).

Since it is weather conditions that limit the time the local fleet fishes, each hour saved in the launch and retrieval process is an hour of additional harvest time for the subsistence fishery. There is considerable room for expansion of local fleet activities, and local fishermen have stated a small boat harbor is needed so they can increase their subsistence harvest. Lost time, during the nine months per year the fleet is expected to be used, is summarized in table 10.

Table 10. Lost of Fishing Time

Haul Out	216–351 Hours
Waiting For Haul Out Service	972–1064 Hours
Put In	216–351 Hours
Waiting For Put In	972–1064 Hours
Number Of Times Per Year	5–10[30]
Total Lost Time Estimate Range	**11,880–28,300 Hours**

7.7 Harvest Near Saint Paul

Since Saint Paul does not have a small boat harbor, the rich stocks near the island are harvested by vessels working out of Dutch Harbor and more distant ports. Costs are higher for vessels working out of Dutch Harbor due to the added travel distance. Dead loss of crab also results from the added time and distance. In this report dead loss of crab has not been quantified.

[30] Deep water waves from the N and NW +6 ft approximately 20% of the time x 90 day in-water period for the fleet x and assumed 2 to 4 days storm duration. Initial estimate was provided by CBSFA operators.

7.8 Water Taxi

Large trawler and crabbers regularly call at Saint Paul for crew change, supplies, and medical assistance. Because the harbor is so busy, vessels frequently wait outside for a clear channel or vacant tie-up space. Vessels occasionally wait eight or more hours. They have no choice because the next port is 275 miles away. With a small boat harbor, a water taxi service could call on vessels waiting outside, and deliver people and supplies.

7.9 Subsistence Harvest

For the Aleutian Island area, data gathered by ADF&G in 1994, reveals average per person subsistence harvest is 378 lb per year. At Saint Paul it has been 267 pounds. Alaska's highest per capita subsistence harvest is at Hughs where it is 1,498 pounds. A study by ADF&G in 1989, Alaskan's Per Capita Harvest of Wild Foods, summarized the following as factors accounting for some communities having extraordinarily large per capita consumption rates:

- The subsistence harvest is high because it is used as a substitute for milk products (the single largest item in the American diet), fruits, vegetables, and grains. In the U.S., average meat and poultry consumption is 255 lb per year, but in Saint Paul the subsistence harvest also provides clothing, home goods, trade, items, ceremony, arts and crafts, and other uses (Saint Paul has a single retail outlet.).
- Native communities harvest more wild foods than communities with higher non-Native populations (The Saint Paul resident population is 79% Native.).
- Generally, harvests increase as the distance from road systems increase (Saint Paul is a remote location.).
- Because of high cost of transportation and storage, store bought foods in rural areas can be expensive, and many choices very limited (Most passengers and freight are delivered to Saint Paul by air.).
- Lack of a protected launch area and lack of a protected moorage limit the number of days that small vessels can be used for harvest. Residents are very vocal in their need for a safe place to serve as a center for traditional subsistence practices.

8.0 LOCAL PLANNING CRITERIA

In community meetings with the sponsor, local fishermen, and community groups, a list of planning criteria surfaced. Popular support was voiced for the following:

Navigation Season. Local fishermen desire a plan that can be in use all year. Harbor plans that call for seasonal removal of docks and vessels will be a low priority option. The project would need to provide all weather, year-round protection.

Security. The harbor would need to be in a secure location. Locations that minimize access by visitors would be given a preference.

Location. The project would need to be out of the way of larger vessels. Previous analysis indicates the preferred location for a small boat harbor is within the general confines of the existing Saint Paul Harbor. There are several alternative configurations under study, but all are within the confines of the existing area protected by the outer breakwater.

Size. The harbor alternatives should evaluate sizes ranging from 30 to upwards of 60 vessels and should accommodate vessels up to 58 feet.

Economic Efficiency. Benefits would need to exceed costs. From the community point of view, alternatives that maximize local benefits at minimum local cost would be preferred.

Adverse Environmental Impact. Island residents indicated that any small boat harbor plan must first consider avoidance of all adverse environmental impact and secondarily consider mitigation of effects. Disruption of nesting and feeding habitat should be minimized. There are four sensitive areas associated with any additional harbor improvements within Village Cove: water quality, Salt Lagoon, fur seals, and Boulder Spit with its least auklet colony.

Water quality has remained high within Village Cove with the present vessel traffic and ancillary uses. All three processors that have operated in the harbor have used untreated Village Cove water in their crab processing operations.

Salt Lagoon is an extremely productive, unique habitat. None of the proposed small boat harbor alternatives would physically impact Salt Lagoon nor do they lend themselves for future development, which would physically impact the lagoon. Potential impacts associated with the construction of a small boat harbor would be associated with water quality.

The number of juvenile fur seals using Village Cove appears to be increasing. An estimated 1,000 animals were present in Village Cove in the fall of 1996. They appear to congregate near the entrance to Salt Lagoon in the area of the proposed north breakwater and proposed Federal access channel. The fur seal juveniles will probably haul out on the proposed north breakwater and will swim in the access channel. The potential impacts associated with the vessel/fur seal interaction are not known.

Boulder Spit provides nesting habitat for about 16,000 least auklets. It does not appear that any of the proposed small boat harbor alternatives would have a significant adverse effect on Boulder Spit. The dredging of the sediment management area may be restricted to periods when the least auklets are not nesting.

There does not appear to be any practicable means to avoid impacts associated with the design of the proposed small boat harbor in Village Cove. The proposed design does however seek to minimize impacts by giving flood flow preference to the eastern harbor entrance channel. Mitigation to avoid impacts will have to be in the manner of operations and management practices. In order for this kind of mitigation to be effective, the local sponsor must develop a harbor management plan with specific criteria to minimize both water quality degradation and interaction with fish and wildlife resources. An effective plan would probably require that these regulations become city ordinances, and that a strategy and policy in support of enforcement be developed.

Existing Port. Development of plans must be consistent with and complementary to the existing deep-water harbor. Alternatives must not physically interfere with the present configuration of the deep-water facilities. To the maximum extent possible, operation of the small boat harbor alternative plans must alleviate congestion and safety concerns associated with small boat traffic in the vicinity of the deep-draft facility.

Phased Development. The sponsor wants a plan which is flexible enough to allow for incremental addition to, or changes in configuration of docks, as local needs demand. The advantage to them is that this could allow them to more carefully time expenditure of some construction funds, timing to needs as they develop. It is also a means of applying adaptive management to address the uncertainty inherent in fleet and harvest projections.

Harbor Water Quality. The objective is for the day fishery and main harbor water to be exchanged in a pattern as similar as possible to the without-project condition. Steps need to be taken to assure trash, sewage, and oil and greases are collected. Normal ebb tide flows from the Salt Lagoon through the harbor should remain as they currently exist.

Salt Lagoon Water Quality. Tidal flushing is not to be impaired by the small boat harbor.

Waves. Waves in the small boat harbor are to be reduced to 1.5 ft or less under the most adverse storm conditions.

Currents. Currents should be less than three fps. Engineering should maximize opportunities to develop circulation gyres to enhance flushing under normal tidal exchange.

Sedimentation. Sediments are to be managed so their interference, with the small boat harbor and main harbor facilities, is minimized. Maximum effort should be extended to develop beneficial uses for dredged material.

Compliance with the Saint Paul Ataqan Akun Community Plan. Alternative plans must not conflict in any significant manner with other land use and development plans. Many of the values specified in the plan emphasize (1) stewardship of the island; and (2) preservation of unique aspects of the Aleut community as important, fundamental concerns steering development of the community. Planning activity represented in this report is consistent with community guidelines related to expansion of the harbor, development of a small boat harbor, preservation of adequate harbor space for processors, and minimization of environmental impact. The planning activities in this report are consistent with local policy related to keeping the harbor expansion generally within the area presently developed within the harbor, making the best use of available land, provision for adequate moorage, loading facilities, and storage and repair facilities to support local fishermen.

9.0 IDENTIFICATION OF ALTERNATIVE PLANS

During local planning meetings that spanned the November 1996–October 2000 timeframe, a local planning committee consisting of representatives from the City, Aleut Community, Pribilof Bering Seafood, Bering Sea Eccotech, CBSFA, and TDX, continued a mission to develop concept plans. The priorities put on the planning criteria by the committee reflected the following concerns:

- Design must be beneficial or non-harmful to Salt Lagoon.
- Beneficial use of the IRA Tribal Operation area is necessary as part of the project.
- A pro-active role by the Aleut Community and TDX seeking future permits for development of inner waters and adjacent land could be expected.
- Respect for existing property rights and land use plans was required.
- Accommodation of future changes in the local fleet was a stated goal.

During the planning sessions three basic alternatives were identified, and through follow-up input from Aleut Community of Saint Paul, Pribilof Bering Seafood Ltd., Bering Sea Eccotech, CBSFA, and TDX Corporation, four other concept plans emerged. The plans differ in (1) their breakwater configuration and location; (2) two major factors impacting the ability of the plans to serve as an all weather, year-round harbor and to do so in a cost effective way.

Hammerhead. This plan, near the vicinity of the spending beach and maneuvering basin, is a rubble fill foundation with a timber trestle. The trestle allowed access to the head that could be utilized as wharf space for the trans-shipment of goods. The plan was discarded as it concentrated storm generated current in the mooring area and would not have reduced wave activity to the extent other plans could.

Floating Breakwater. Located adjacent to the TDX docks at the south end of Village Cove, this plan would use an anchored vessel to dampen wave activity. Wave attenuation of such a structure in the long period wave climate would be primarily by reflection. The added wave activity in the reflected wave path would adversely affect other harbor operations. Currents in the harbor, under design storm conditions, could make mooring the structure very difficult. The alternative was rejected from this study, based on its adverse affects on harbor waves.

South Village Cove. Also suggested as TDX plan 3A, this plan is at the same location as the floating breakwater plan. It consists of a short north breakwater and a west breakwater near the public access area. The small boat harbor consists of two docks and occupies about twelve acres. Of the plans examined, it is the plan that has the maximum potential for meeting planning and engineering goals. It could also meet late surfacing goals of a tribal dock and temporary moorage of the 100 ft plus vessels. Six size and depth variations of this plan were pursued in the later stages of study to develop the NED plan.

TDX Plan 4A and TDX Plan 2A. TDX conceptual plans 4A and 2A are variations of a two dock concept that incorporate moorings for vessels larger than anticipated for the small boat harbor and also include a major dock facility. As the financial benefit of the added facilities is not obvious, and the analysis is beyond the needs stated in this study, the additional cost have not been estimated. The increased cost will however be significant. Both of the plans have one environmental characteristic, which also was a factor in eliminating them from further consideration. Both plans are configured so as to require the major proportion of flood flow water entering Salt Lagoon to pass through the harbor complex before entering the lagoon. This is an ideal situation for the harbor but puts a higher potential for Salt Lagoon contamination in the system than agencies will probably deem reasonable. Both plans will also have major problems with high velocities during and immediately after storm events.

Salt Lagoon. Also suggested as TDX plan 1A, this is a harbor located in the entrance to Salt Lagoon. It would be well protected from waves but would suffer from exposure to high velocity flows when storm surge water volumes are purged from the Salt Lagoon. A harbor in this location would also eliminate bird-feeding habitat and expose Salt Lagoon to a higher potential for contamination than may be desirable. The harbor would be located in what should be sand deposits, and the excavation costs, other than for the approach channel, should be minimal. An in-depth evaluation was not undertaken due to the potential for Salt Lagoon contamination.

Westerly Harbor. A harbor site about 200 ft west of the site adopted was examined as water depths appeared favorable. Examination of the wave climate and currents during storms, depicted in model studies, indicated that both a wave barrier and current barrier extending out from the south shoreline would be required to protect moorage on the south shoreline. When such a structure was placed near the Icicle Seafood barge, most of the existing depth advantage was eliminated by the breakwaters footprint. Placement of the harbor in that location also constrained other potential harbor uses. As there was no major cost advantage to a harbor at this site, and there would be major losses in benefits to other users, the site was not studied in detail.

10.0 ECONOMIC EVALUATION

10.1 Overview

The projected fleet was used as the basis for an expression of moorage needs to be addressed by the concept plans. The seven concept plans were developed first with regard to the fleet projection and second with regard to other planning criteria previously described. Using the above criteria to guide a plan formulation process, engineering analysis was applied to determine cost and performance of the projects. That process narrowed the seven concept plans down to one preferred location (South Village Cove), which presented the least cost option for meeting all planning criteria while still being the best performer. The selected site was then used for various breakwater and harbor layouts to generate various scales of harbor plans.

During refinement of the South Village Cove site, three harbor sizes were identified for engineering studies; 30, 60, and 90 vessel harbors. The 60-vessel harbor was evaluated at three depths. The character of the site is such that after the basic pieces of the project are in place, expansion from a 30-vessel harbor to a 60-vessel harbor can be done at low incremental cost. Beyond 60 vessels, fast land and dredging cost began to drive up the incremental cost.

10.2 Evaluation Criteria

The identification of project benefits under the NED criteria is based on increases in the net value of national output of goods and services, expressed in monetary units. It includes the value of goods and services that are marketed and those that are not. Benefit cost analysis is the technique used to identify and value the effects.

10.3 Evaluation Framework

Corps' planning is conducted in a with-project and without-project context. By comparing forecasts of future conditions in a study area without a project to forecasts of conditions with a project, the differences in costs incurred by and benefits accruing to the study area, as a result of the project, are more readily identified. In order to ensure that plan alternatives are economically efficient, it is necessary to impose the condition of economic rational behavior on individuals and firms in both the with- and without-project condition. The result of the evaluation is identification of a theoretical willingness to pay for the project outputs and is used to express the NED benefit, regardless of who will actually pay. In this analysis four techniques had a role in estimating willingness to pay:

Actual market prices. Used to determine exvessel harvest values

Changes in net income. Used to estimate fleet development

Cost of the most likely alternative. Used to estimate benefits due to project caused improvements in harbor efficiency, travel cost, and subsistence harvest

Administratively established values. Used to estimate opportunity cost of time

10.4 Application

Benefits were evaluated for alternatives that could meet the planning criteria, and NED evaluation principles were applied. If an alternative plan was judged not able to meet the planning criteria, and not able to be modified to meet it, the plan was dismissed on grounds of non-performance. Since the plan alternatives are in the same locale (varying in distance from one another by less than a mile), benefits are essentially the same for each project when the alternatives are similarly scaled. The prime difference in benefits will be the number of vessels accommodated.

10.5 Uncertainty in the Evaluation Procedure

The process used in this report is based on a comparison of the conditions with the project against conditions without the project. This comparison method captures the economic behavior of fishers and the harvest activity they would be involved in with the harbor and without it. In this particular harbor study, both the without-project condition and the with-project condition are subject to significant uncertainty. This resulted from the fact that Saint Paul does not now have a small boat harbor, and small vessels are overall a relatively small part of the Bering Sea fleet. The uncertainty, however, is mitigated by the fact that Saint Paul enjoys the obvious economic advantage of being at the center of the resource.

There are elements of the evaluation where basic data was lacking and which had to be analyzed with use of anecdotal information, data from small samples, or data transfer. These areas of uncertainty are discussed in the Risk and Uncertainty section of this report.

An economic evaluation uses estimating procedures for purposes of resource economics, because there is an absence of markets to rely on for some direct benefit measures. Estimating procedures generally need to pass the test of reasonableness, completeness, reproducibility, and accuracy. In this report the reasonableness of scenarios has been checked through independent review by industry participants. In addition, the scenarios and data had to be demonstrated as being rational in an economic sense to meet the test of independent professional review, which also verified reproducibility. Completeness was verified using side by side comparisons of with-project and without-project cost comparisons. Accuracy was also verified by independent review. Where sensitive areas of data or methodology were discovered, they were evaluated as range values in the Risk and Uncertainty section of the report.

10.6 Methodology in the Evaluation

The evaluation started with an assessment of the resource. This was central to drawing some inference about what type of fleet might operate out of Saint Paul. To be viable a Saint Paul fleet will need to operate at a profit and be the least cost location from which to operate. The resource assessment provides the basis for estimating potential gross income.

In the analysis, the daily Saint Paul harvest was constrained by vessel size. This is an important concept and is a serious limit on the potential of a small boat harbor at Saint Paul. Typically the Bering Sea resource is harvested by vessels in the 90–230 ft class, much larger than the maximum 58 ft size that will be accommodated at Saint Paul. The huge vessels stay on the fishing grounds for a longer time. They also enjoy certain economies of scale and are more able to withstand the sea conditions in which they must operate for long periods. A harbor at Saint Paul offers a harbor of refuge just a few miles from the fishing grounds, thus allowing local vessels under 60 ft to maximize harvest on a daily basis and return to port nightly. Vessels under 60 ft will be profitable at Saint Paul.

Generally, the stocks near the island were inventoried in terms of allowable catch. The allowable catch was allocated to a Saint Paul fleet, based on the portion of the eastern Bering Sea fleet, that was under 60 feet. This was supported by a demonstration that Saint Paul is the least cost base of operations for vessels under 60 feet.

The total number of vessels that the gross income could support was determined using published net to gross ratios. It was then necessary to determine the size distribution of the future fleet. For this, it was assumed that the Saint Paul fleet would mirror the distribution of vessel sizes in the prior IFQ halibut fleet. This assumption was supported by the fact that the Saint Paul fleet will be a multi-species harvest, and the pre-1995 halibut fleet also had the characteristic of being 100% multi-species. In addition 80% of the halibut fleet was made up vessels under 60 feet. There is no other Bering Sea fleet with comparable characteristics.

While deriving the size and characteristics of the fleet, an evaluation of the vessel operating scenarios was also in progress. This resulted in a rationale for the typical harvest, operating days, and cost details. Vessel operating budgets drew on published studies and allocated the harvest costs between fixed and variable components.

Given the make up of the fleet, the cost of operations, and the harvest income, a comparison was made of operating out of Saint Paul and out of alternative ports. This is the heart of the benefit evaluation. In addition alleviation of the problems incurred by the limited fleet operating at Saint Paul in the without-project condition were also identified and quantified as benefits. The part of the evaluation that is directly related to benefit evaluation is detailed in the following discussion. Assessment of the resource, estimate of the harvest, and derivation of the fleet are in preceding sections of this report.

10.7 Use of Opportunity Cost as a Basis for NED Benefits of Harbor Improvements

For NED analysis of transportation, the Corps estimates the difference in cost of delivering a commodity[31]. For the NED analysis of harbor improvements that benefit commercial fishing, one looks into the difference in cost of the harvest[32]. Generally, in the NED frame of reference, capital costs are a necessary input to estimating hourly costs[33].To the extent capital

[31] Published paper version of Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementation Studies, (P&G as presented in Corps of Engineers Engineer Regulation ER 1105-2-100, paragraph 6-59, 6-75).

[32] Ibid Para 6-117

[33] Ibid, Para 6-59 a. ."the benefit is the reduction in economic cost of using the waterway.", and para 6-117"…Harvest costs include…cost of equipment ownership and operation…"

costs are affected by a project, they are a NED consideration[34]. For this report it was assumed that relevant NED costs are limited to differences in short-run variable cost outlays of the harvester. This can be argued as a significant understatement of NED effects because the literature indicates it is not costs that are relative to the fisher, or to the shipper, it is costs that are relative to the nation that matter. The net effect on the nation is the basis for NED economics[35]. This is an important concern and is a subject of discussion in the section on Risk and Uncertainty.

10.8 Reduced Transportation Cost Related to the Harvest Activity

The local economy and the harbor will not undergo significant changes without the project. The strategy of the community is to develop a multi-species harvest and processing complex that will not be economically viable without a small boat harbor. Therefore, there are few changes expected for the local fleet if a harbor is not built.

Without a project, harvest of the resources around the island will be by vessels operating out of Dutch Harbor and delivering there. A run of between 215 and 340 miles is necessary to reach the main eastern Bering Sea fishing grounds from Dutch Harbor. This open-water trip would need to be made with vessels heavily loaded and under frequent adverse weather conditions. This is not consistent with use of vessels much under 58 ft, therefore, the small vessel fleet anticipated in the with-project condition will not develop without the project. Nor will there be fleet expansion at any other location without the project.

Existing vessels operating out of Dutch Harbor will use a three day trip out, of which about 30 hours will be spent fishing, compared to the six-hour fishing periods for day trips out of Saint Paul. This allows both fleets to harvest to the maximum potential of vessel capacity and is the most economical mode of operation. The operating scenario for the two fleets would also differ in that the Dutch Harbor vessels are anticipated to be actively involved in the fishery every day when the weather is suitable. This gives the Dutch Harbor vessels an advantage in terms of catch per harvest day and fewer vessels are needed to conduct the harvest. This advantage is somewhat offset by the increased travel time to and from Dutch Harbor.

To harvest stocks near Saint Paul (assuming GHL is maintained at the average of the last ten years and seasons characteristic of serious cut backs in low harvest years), it would take a fleet of 38 vessels. However, if season restrictions are set aside, it would be theoretically possible to conduct the entire harvest of stocks that would have been harvested from Saint Paul by operating only four vessels out of Dutch Harbor. A fleet of four was used merely for purposes of simplicity in the benefit calculation. With a larger fleet, the number of operating hours, the total operating time, and variable cost will remain the same and is merely spread among more vessels. All four would be 58 ft, however, two would be a larger version with capacity of 90,000 pounds. They would be 58 ft by 23 ft by 9 ft and would be rated at over 1,700 horsepower. The heavier version has the capacity to operate as mid-water trawlers. The

[34] Ibid 6-117, …The NED benefits are conceptually measured as the change in consumer's and producer's surplus as a result of a plan."

[35] Ibid page 5-16, "Resource use is broadly defined to include all aspects of the economic value of the resource. This broad definition requires consideration of the direct private and public uses that producers and consumers are currently making of available resources and are expected to make of them in the future."

two lighter, standard type vessels would be a more conventional sized “limit seiner” combination vessels. They would be 58 ft by 17 ft by 8 ft, and would be rated at 420–870 horsepower. This scenario, based on a fleet of four vessels, is an ideal situation where every harvest day results in a maximum harvest within a 30-hour period. For this scenario each vessel would make 55 round trips with each round trip requiring about 43 hours more travel time to and from Dutch Harbor than daily trips in and out of Saint Paul. The trips would result in average payload at 50% of vessel capacity. This reserves 50% of the capacity for ice, sea water, salt, or harvest shortfall due to weather, mechanical problems, low success rates, or unanticipated difficulty. At present, there are vessels in this size range operating out of Dutch Harbor targeting stocks of the eastern Bering Sea.

The hourly vessel operating budgets generated for this report are $134.30 and $56.80 for two configurations of 58 ft vessels. The travel cost under the without-project condition is $635,200 (larger 58 ft vessel) and $268,600 (smaller 58 ft vessel) for a without-project harvest related travel cost of $956,800. In addition, there are 17 small vessels fishing an average of 22 days out of Saint Paul with an annual variable cost of $53,000. When compared to the with-project condition, travel cost of $596,500, the saving provided by the small boat harbor will be **$360,300** annually.

Table 11. Without–Project Harvest Related Travel Cost

Size	Fishable Days	Days Fished	No. Vessels[36]	RT Hours	Cost/Hour ($)	Total ($)
0–25 ft	48	14	28	Nil[37]		
26–32 ft	73	22	17	2,244	23.60	53,000
58 ft by 17 ft (beam)	159	159	19[38]	4,730	56.80	268,600
58 ft by 23 ft (beam)	159	159	19	4,730	134.30	635,200
						956,800

Table 12. With–Project Harvest Related Travel Cost

Size	Fishable Days	Days Fished	No. Vessels	RT Hours	Cost/Hour ($)	Total ($)
0–25 ft	48	14	28	Nil		
26–39 ft	73	22	17	2,244	23.60	53,000
40–55 ft	147	44	13	3,432	53.50	183,600
55–58 ft	159	48	22	6,336	56.80	359,900
						596,500

10.9 Prevention of Damage

Based on discussions with fifteen local fishermen, existing damages to vessels and equipment is related to the following:

[36] Of the total 26 use the seasonal docks, 20 are hand launched skiffs, and the balance operate out of Dutch Harbor.

[37] The trailerable fleet fishes within one mile of the harbor and travel distance and cost is negligible. These are primarily subsistence fishers.

[38] These 58 ft vessels operate out of Dutch Harbor. Without season restrictions the harvest of these 38 vessels could be accomplished by a fleet of four.

- Wind tidal currents and wave action that pushes vessels into one another as they wait to be hauled out.
- Wind, tidal currents, and wave action that set vessels onto shoals near the launching area.
- Larger vessels, which take the right of way, squeeze the local fleet away from tie-up locations.

Skippers gave examples of incidents involving several vessels. Most of the damages are preventable by proper fendering, assembly of rafts, and continuous attention to lines. The incidents, which are not preventable by anything other than a new moorage area are those which involve individual vessels or groups of vessels being set onto the rocky shoal at the narrow, constricted location where they queue up for haul out. Each year there are three or more vessels receiving major damage to shafts, outdrives, or hulls. The extent of damage has varied from replacement of outdrive units to sinking of a vessel. Preventable damage for three recent years was reported to be $6,000, $22,000, and $9,000. Average annual preventable damages are estimated at $12,300. This represents damage preventable to the existing 26-vessel fleet.

The fleet, under the with-project condition, is expected to expand to 50–60 vessels as early as the year 2002 and no later than 2005. The vessels, which will be added, are larger than the local fleet and will be relocated from other ports where they experience similar damage. For example, average annual damage per vessel at Dutch Harbor was reportedly estimated at $5,000 in 1999. [39] Relocated vessels will add to crowding problems in the harbor, but the harbor will have been expanded and improved. These vessels will be more maneuverable inside the new harbor, and to some extent, they will be less susceptible to damage. The vessels also will be able to avoid some of the harbor congestion by waiting outside.

Benefits estimated for prevention of damage to the expanded fleet are based on judgment that larger vessels will be less likely to be damaged, but due to potential contact with smaller vessels, damages to the smaller vessels will increase. In addition, damages to the overall fleet are expected to be a function of value as well as crowding. Potential increase in value of the fleet (estimated at 2.2 for a 50 vessel fleet and 10.4 for a 60 vessel fleet), combined with fewer incidents resulting in damages to the larger vessels, has been accommodated with the following expression, (26 vessel fleet damages x 2) x (fleet value factor/2). The value factor for the 60-vessel fleet reflects the addition of four large dimension 58 ft vessels, which are not present in the 50-vessel fleet. Preventable damages for the 50 vessel fleet are ($12,300 x 2) x (2.2/2) = **$27,000** and for the 60 vessel fleet are ($12,300 x 2) x (10.4/2) **= $127,900.**

10.10 Prevention of Theft

Presently the vessels are stored wherever there is useable space available. This finds them scattered throughout the industrial area and around the island. Little of the outside area of the island is illuminated at night, and there are no fences to allow vessel security. In addition, the community is host to hundreds of vessel stops each year, and there are frequently large numbers of outsiders coming in to work at the processors or waiting to be picked up as crew

[39] In 1999 Corps staff gathered information regarding operations at Dutch Harbor in connection with potential navigation improvements there.

replacements. Sometimes the number of transient people almost outnumber the local residents. Local fishermen have taken to removing their equipment, when the vessels are stored, and locking their vessels. Still when vessels are left unattended for short periods just before or just after a fishing trip, theft is common. The most common items taken are electronic navigation equipment, safety equipment, survival suits, gas cans, and fuel. All of the theft would be preventable in a secure harbor with controlled access, a 24-hour security service, and fenced area.

There is no solid statistical data available to estimate the losses associated with theft, although at a local meeting with a group of fishermen, one person speaking for others suggested that average losses were about $1,000 per year for each theft event. Others in the room agreed to this estimate, and of the fifteen fishermen present, none of them were willing to state that theft was not a big problem. All of them expressed some experience with theft loss. Preventable theft loss is estimated at **$5,000** per year for the present fleet. Vessels expected to be added to the fleet will be much larger and of more value. It is presumed these vessels will experience equivalent theft losses at other locations. With fleet value increases of 2.2 and 10.4 for the 50 and 60 vessel fleets, preventable theft losses are estimated at **$11,000**, and **$52,000** respectively.

10.11 Prevention of Vandalism

Vandalism is a continual problem for vessel owners and happens in any open moorage. There is some overlap of complaints of vandalism problems with theft problems. The vandalism, however, differs in that the stolen items are usually discovered damaged, broken, or discarded. Recent complaints included anecdotes involving slashed survival suites, gas cans recovered empty, VHF radios recovered with the cases smashed or removed, skiffs used and abandoned, and broken windows in stored vessels. All of the vandalism could be prevented if vessels were in a secure moorage. Preventable damages are estimated at $2,000 annually for the current fleet and are adjusted by estimated fleet value factors to arrive at **$4,400** and **$21,000** for the 50 and 60 vessel fleets respectively.

10.12 Water Taxi

Prospects for a water taxi service were verified with local interests, who have been in the business and who have evaluated profitability of the venture at Saint Paul;[40] and others that support its need and practicality. The benefit evaluation for the local water taxi idea originated from statements made by members of the community. Data is considered to be reliable as persons interviewed had actual experience with the water taxi operation; and had actually initiated one at Saint Paul but had to abandon it due to lack of a protected local moorage for the taxi vessel.

There is no lead-time required to re-establish the taxi operation at Saint Paul beyond that associated with the construction of the project. The time line for project construction will be the controlling factor regarding when a water taxi can again become operable, because

[40] Onsite interview with John R Merculief as principal participant and former water taxi operator. Other related discussions on the subject included active participation by Andrey Mandregan, Jason Bourdukofsky, Anthony Philemonoff, Ricardo Merculief, Jeff Kauffman, Pat Baker, Jacob Merculief, Richard Zakarof, Jason Bourdofsky, Bill Arterburn; and passive participation by others making up a total of 19 contacts.

without the project, a water taxi is impractical. It is valid to assume that the taxi operation will be initiated in project year one, because that is the schedule that maximizes prospects for net income, and there are no hurdles in the way of implementation of the taxi operation.

Large trawlers and crabbers over 90 ft regularly call at Saint Paul for crew change, supplies, and medical assistance. During a 1999 sample period of port records for a 300-day period, harbor records show 1,680 tie-ups at dockside by these deep-draft commercial vessels. Some of the sample data was during an extended season closure, so vessel calls for offloading at local processors, and some refueling and repair calls are not included. Season closures are common, and in this case, the extended closure resulted in calls at Saint Paul being reduced to about half of what they would be without a closure. Nevertheless, because the harbor is so busy, many of these vessels were frequently required to wait outside for a clear channel and a place to tie up. Vessels occasionally waited eight or more hours, but the normal waiting period was generally two hours or less. If they wanted to use the harbor when it was full, they had no choice but to wait because the nearest alternative port is 275 miles away.

The harbor records identified the vessels by name and purpose of the visit. The record also showed the arrival and departure time. It did not reveal how long the vessel had to wait outside before being allowed to enter the harbor. There is ample data, however, to serve as a guide for assumptions necessary to make an estimate of waiting time.

During the 300-day sample period there were 1680 arrivals, with a peak daily number of 25. Mean of the distribution was 12, and the standard deviation was six. The average time at dockside was eight hours. During the 300 days, the average occupancy rate allowing for one vessel at each of three docks was 62%. Average service rates do not bear any relationship to waiting problems so queuing analysis ordinarily relies on a complete record or a simulation. For this report, four simulation approaches were used. In one it was assumed that one of the docks would be useable for double berthing, and all of the arrivals were therefore distributed to four berths over a 300-day period using a random number simulation. The arrivals were sorted to identify the number of days there were over four arrivals. This is the theoretical beginning of waiting events, because after four arrivals, it is possible the fifth might arrive when all four berths are taken.

Next, the daily arrivals over four were grouped into 16 one-hour periods to denote the number of vessels that would be competing for use of the docks during the theoretical open period. A normal distribution of arrivals was assumed. It was also assumed that waiting would actually become significant after eight arrivals in a day. The simulation showed there would be 998 such arrivals. Since it is common practice to call ahead to clear arrivals with the harbormaster, there is already some scheduling strategy at work. This works to reduce congestion in the harbor and places a reasonable limit on waiting outside. If a long wait is anticipated, vessels slow down or fish longer, or in the worst case, seek an alternative port. There is no recorded data, however personal communications on this subject indicate waiting outside has been up to eight hours but is generally one to three hours or less. For the fleet during the sample period, this would be a range of 998 to 2,994 hours, and the midpoint would be 1,996 hours.

A second approach to narrow down the waiting estimate was use of an Erlang type C queuing simulator[41]. For this simulation, a maximum daily capacity of 32 was used, which overstated the actual historical maximum by 22% to allow for outliers anticipated to be present in a larger sample. The initial iteration assumed zero downtime and zero time required for transition of berths from one vessel to another. The model estimated there would be 135 waiting events and 607 delay hours. A second iteration incorporated downtime and turnover time into the service estimate, and this expanded delay to 2688 hours, and the midpoint of the two estimates was 1,647 hours.

The distributive properties of the sample data were calculated and applied the assumption that waiting would become a problem when service exceeded a 50% use rate[42]. This indicated 780–2340 hours of waiting or about 1560 as a midpoint estimate. A fourth verification used a Simul8 Model purchased for this study, and it yielded a wait estimate of 2520 hours for the two configurations.[43]

The most acceptable estimate of 1996 hours was settled on largely because of ease of explanation and reproducibility. However, this and the others were regarded as low-side estimates because early season closure reduced the number of vessel calls by as much as half.

With a small boat harbor, a water taxi service could service vessels waiting outside and deliver people and supplies. With the call-ahead strategy in place, a water taxi service, based at the small boat harbor, could be on the scene with supplies, parts, and personnel as the customer arrived, thus reducing waiting time. Since a water taxi should be able to service vessels, waiting outside in a wide range of weather conditions, the operating cost of the taxi was based on a 58 ft vessel. Hourly operating cost of the water taxi was estimated at $56.80 per hour.

For purposes of estimating delay cost of the waiting commercial vessel, horsepower data gathered from 57 of the Bering Sea fleet of vessels ranging in size from 90 ft to over 160 ft was used to estimate a fleet median fuel use rate. The horsepower range was 582–4,033 with a median of 2,307. Based on information from the Caterpillar Company, a Cat 3516B marine diesel was selected to estimate fuel consumption rates. Depending on the power setting, the fuel burn rate varied from 13.7 gallons per hour (gph) at idle to 100.7 gph at maximum power. A rate of 57.2 gph was used as a mid-range setting, based on judgment that the vessel would need a moderate power setting to hold a position in an adverse sea and wind condition. The fuel price used ($1.30 per gallon), which adjusted the total hourly fuel cost up by a factor of 1.21 to include non-fuel, variable-operating cost. The result was an hourly cost of $90 for holding outside of the harbor.

As a check on the estimate data, was compared from a 2000 study of Dutch Harbor/Unalaska by the Corps', Alaska District, which estimated the hourly cost of the 100–159 ft deep-draft commercial vessels. Hourly cost of the 100–159 ft vessels were based on a transient fleet that spends 285 days, participating in a number of fisheries in the Aleutian Island region. In the referenced study, data was obtained from interviews with BSAI fishers and from statistics

[41] Erlang Software, 3 Barker Place, Bicton WA 6157 Australia

[42] Based on classic Erlang distribution interpretation.

[43] SUMULAT8 200v6, Sumulat8 Corporation, 141 Saint James Road, Glasgow G4 OLT Scotland UK

provided by the Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, as well as other reliable sources. Fuel consumption estimates were based on interviews with fishermen, Alaska Department of Fish and Game, a major diesel engine manufacturer, and two vessel companies. Based on their knowledge and experiences, it was determined that a 100–159 ft crabber/tender class consumes approximately 60 gallons of fuel per hour. Lube oil expenses were estimated at 7% of fuel costs. In that study, average daily costs were calculated by averaging the total costs over the total number of operating days, 285. Hourly costs were computed by dividing the daily operating costs by 24 hours.

The hourly operating cost for maintenance and stores ($179,000 divided by 285 operating days) divided by 24 hours was $26.17. Based on the fuel consumption rate of 60 gallons per hour and an average fuel cost of $1.30 per gallon and lube oil, 9 cents per gallon (60 gallons x $1.39), fuel and lube was $83.40. Therefore, the total hourly operating cost ($26.17 + $83.40) is $109.57 or $110. Ninety dollars per hour was used to adjust for the fact that the waiting vessels would be at a low power setting, and this lower setting was not necessarily a consideration in the Unalaska/Dutch Harbor study.

Information on cost of 18 actual short-term charters of crab vessels by ADF&G for research purposes, during the 1990s, was used as additional verification. The charters were for sampling work, during the fair weather periods of August through October with most of the work during September. The charters were hired through a publicly advertised bidding process, announcing the dates the vessels were intended to be used and inviting competitive bidding to identify the least cost source. The charter periods were from 15–35 days and the 18 winning low bids had a median cost of $173 per hour when adjusted to a 2000 price level. (see table 13)

A complication in adapting the data to estimate hourly variable cost is that some of the bids appear to be based on recovery of variable cost while others are based on recovery of total cost. This is evident from the skewed nature of the data. After contacting people associated with the bidding process, it was assumed that the lowest three winning bids represented attempts for skippers to cover variable cost in the short-run and that the highest three were based on recovery of total cost. The lowest three winning bids came out at $94 per hour and the highest came out at $269. Inclusion of variable and fixed cost by 83% of the winning bids would appear to be an appropriate market statement that opportunity cost of tying up a vessel is larger than the out of pocket variable cost. The data was interpreted as verification that our estimate of $90 per hour is valid as an estimate of short-run variable cost.

Table 13. ADFG Bering Sea Test Fish Project Vessel—Charter Statistics Between 1990–1999

Year	Contract Award	Charter Dates	Total Days	Rate/Day ($)	Total Cost ($)	Index[44]	2000/	hr
1990	F/V Kristen Gail	8/7 to 9/7	30	3,600.00	109,500.00	1	3,600	150
1991	F/V Kristen Gail	9/2 to 10/7	35	5,500.00	192,500.00	112	6,160	257
1991	F/V Western Viking	8/20 to 9/20	30	5,950.00	178,500.00	112	6,660	277
1992	F/V Kristen Gail	10/8 to 10/23	15	1,650.00	24,750.00	113	1,860	77
1993	F/V Cascade	8/20 to 9/20	31	1,800.00	37,800.00	113	2,030	85
1994	F/V Kristen Gail	9/25 to 10/25	30	2,942.00	88,260.00	112	3,290	137
1995	F/V Kristen Gail	8/1 to 8/31	30	3,990.00	123,690.00	113	4,510	188
1995	F/V Notorious	8/1 to 8/21	21	2,500.00	52,500.00	113	2,820	117
1996	F/V Rosie G	8/1 to 8/31	31	3,000.00	93,000.00	115	3,450	144
1996	F/V Peggy Jo	8/1 to 8/25	25	3,836.00	95,900.00	115	4,410	184
1997	F/V Grand Duchess	7/25 to 8/21	28	3,350.00	93,800.00	117	3,920	163
1997	F/V Spirit of the North	7/25 to 8/28	35	3,900.00	136,500.00	117	4,560	190
1998	F/V Viking Queen	8/1 to 8/28	28	3,250.00	91,000.00	114	3,700	154
1998	F/V Notorious	8/1 to 8/28	28	3,880.00	108,640.00	114	4,420	184
1999	F/V Peggy Jo	7/22-8/10	19	5,395.00	102,505.00	117	6,310	263
1999	F/V Notorious	8/1 to 8/15	15	5,470.00	82,050.00	117	6,400	267
1999	F/V Obession	9/25-10/11	17	2,450.00	41,650.00	117	2,870	120
2000	Prelim data	No detail		2,950		130	3,830	160
							Average	**173**

Without the project, vessels waiting cost will be $90 x 1996 hours = $180,000. Wave activity outside the harbor will make it impractical to provide water taxi service 35% of the time so preventable waiting cost is $117,000. Under the with-project condition, delivery cost will take less than an hour per vessel and will be $56.80 x 650 deliveries = $36,900. Benefits associated with water taxi service made possible by the project are **$80,000**.

10.13 Reduced Cost of Vessel Repair

Serious planning is well under way for the design and construction of a vessel repair facility at Saint Paul. Some of the actions that have already taken place include the Central Bering Sea Fishermen's Association (CBSFA) facilitation of a vessel engine repair and maintenance program with Coastal Marine Engine, Inc. Through the program, a certified mechanic will be performing the work on Saint Paul. In addition CBSFA is finalizing a building plan for the vessel repair facility including construction finance, land acquisition, and operations. They have contracted with Polar Consultants as the main engineering firm. Polar sent CBSFA two conceptual layouts for the vessel repair facility in February 2001. Development of the final building plans, including construction finance and land acquisitions are ongoing.

The repair facility cannot become operational until after completion of the harbor because moorage and haul out are essential to a successful operation. The new small boat harbor will supply moorage needed to make a vessel repair operation viable. The repair facility will exist only under the with-project condition.

[44] Department of Labor, Producer Price Index for water transportation class 4424

The repair facility analysis starts with evaluation of regional demand for services and establishes the potential economic viability of a facility at Saint Paul. The evaluation incorporates all of the capital and operating cost of the facility and demonstrates the expenditures to be self-liquidating and in that manner nets them out of the benefit evaluation. Benefits are based on reduced operating cost for vessels at large, because the location of Saint Paul will save the cost of travel to other locations for repair work. Reduction in variable operating cost was used to estimate willingness to pay for reduced travel to alternate facilities.

It was recognized that the delayed or out of service vessels would be unable to recover necessary fixed and variable cost, and these non-recovered costs represent an upper limit on opportunity cost from the NED point of view. In the with-project condition, the opportunity to recover operating costs by reducing lay up and travel time represents the vessel owner's willingness to pay for local facilities. Losses or gains related to fixed costs were not addressed.

10.14 Vessel Repair Benefit Evaluation

NED benefits are earned for reduction in trips to use repair facilities elsewhere. The saved trips relate to the entire customer base throughout the eastern Bering Sea small vessel fleet that would seek repairs and maintenance at Saint Paul.

Parameters used in the analysis include the following:

- The numbers of in-water holding spaces needed for vessel repairs are three. These are not dedicated moorage slots but the transient and auxiliary dock availability on a short-term basis while vessels are preparing to depart after repairs have been completed.
- Composite vessel delay time is $38 per hour, which is a weighted average variable hourly cost of the Saint Paul fleet in the with-project condition.
- Service records at competing facilities, and expert opinion indicate weighted average facility dwell time is 22 days based on the following:

Percentage	34	24	14	18	10
Days	4	10	30	45	60

- 270 day demand period with 200 work days.
- With-project condition has 10 upland facility spaces in 1/2 acre.
- Associated cost of facility development and operation is included at $180,900 annually.
- Without-project practical capacity of 0 vessels per year because of moorage constraints.
- Average water storage time equals dwell time.
- With-project condition has available haul out, transportation, storage, and repair facilities. These associated costs are shown to be self-liquidating.

10.15 Vessel Service Problems

Lack of moorage at Saint Paul places an absolute limit on the number of vessels that can receive repair and maintenance, and adds considerably to the cost and amount of time required to provide service. Without-project solutions available to vessel owners at Saint Paul are the following:

- Bring in a repair crew, tools, and equipment by air from Seattle.
- Ship the vessel aboard a barge to Dutch Harbor, Seattle, or some other repair facility.
- Tow the vessel to Dutch Harbor.

In most cases, even vessels able to move under their own power are required to leave Saint Paul in search of service at alternative ports due to lack of local facilities. Plans are underway for expanded haul-out and repair service facilities at Saint Paul contingent on construction of a harbor and breakwater. Development of repair facilities in Saint Paul will center on the characteristics and needs of vessels in the market around Saint Paul. The market area is a radius of about 300 miles from Saint Paul, which includes the primary alternative harbor and repair facilities at Dutch Harbor.

10.16 Characteristics of the Market for Vessel Service

For purposes of this study a commercial vessel is any vessel that is used in coastwise trade or engaged in American fisheries. Coastwise trade includes the transportation of passengers or merchandise between points within the U.S. According to the U.S. Coast Guard (USCG) reports, there were 31,909 such vessels registered in Alaska as of January 10, 1995. The number of vessels registered with harbormasters in the state is about half the total number of vessels reported by USCG. About 15,500 vessels hold commercial permits.

10.17 Demand for a Haul-Out Facility at Saint Paul

Discussions with fishers at Saint Paul were conducted in 2000 in cooperation with the City of Saint Paul. In response to plans for a vessel repair facility, under the with-project condition, the planning team explored the local interest, regional need, and viability of a proposed mobile vessel hoist facility and vessel repair facility. Of those involved, 100% expressed acceptance of the proposed facility for a variety of reasons. The predominant concern was that, without a haul-out and repair facility, repair crews were being flown in, which more than doubled the annual cost normally faced by fishers. In some cases, vessels remained out of service for long periods due to high cost.

The closest full-service facility, which would compete with Saint Paul's based supply and service is Dutch Harbor. Dutch Harbor is about 275 miles from Saint Paul. However, Dutch Harbor rarely has slips readily available to accommodate vessels and customers may need to wait indefinitely for repair.

Where repairs are concerned, the majority of fishers base their decision of whether to use a port by its available moorage, lift, repair facilities, and reputation. Owners look secondarily to the cost at each facility in making final decisions. Moorage space or dry storage is of critical importance because rarely can vessels be serviced immediately. Waits for service, even with months of advance reservations, are an expected part of the industry. After a vessel has been hauled out and land-based repairs are completed, it is expected to be put back into the water at an available moorage to have other work completed.

There are several repair facilities in Alaska, but there are 31,909 vessels in the state. Prudent practice is that vessels are taken out of the water for cleaning, inspection, and repainting every year or two. Commercial vessels adopt a cycle of planned maintenance that minimizes conflicts with active harvest opportunities. Of the 31,909 vessels, 15,500 hold commercial permits, and 11,300 of these are 58 ft or less in length. Within the state, there are fewer than 20 operating travel lifts and hydraulic trailers with capacity adequate for haul out of commercial vessels over 32 feet.[45] Statewide, there are 13 harbor cranes. Lack of haul-out facilities causes many of the 15,500 commercial vessels in need of maintenance to travel to the Puget Sound area for service. This is a round trip of about 4,000 miles from the Pribilof Island area.

10.18 Facility Requirements

The proposed repair facility must be complete and must encompass adequate work area. Optimum upland sites would be no less than 1/2 acre. On average, 10 vessels 32–42 ft may be stored on 1/2 acre of land allowing for access lanes, buffer areas, and separation. The layout and size of the vessels will determine actual storage capacity. The site must be in the vicinity of water, electrical, sewer, and telephone utilities. A reconnaissance level cost estimate was made, which is limited to the purpose of explaining associated cost. Consulting Economist and Oliver Consulting did the estimate. The estimate was influenced by knowledge of other existing west coast facilities and problems and opportunities relating to the Saint Paul location. It is not intended to be equivalent in detail, reliability, and documentation to construction cost estimates in this report.

There are a number of potential haul-out systems, which could handle vessels coming into Saint Paul. The preferred equipment for lifting vessel types at Saint Paul is a hydraulic trailer. Coupled to a tractor the unit can be used to move vessels to a repair facility or to a seasonal storage area. The trailer offers versatility, as it is ideal for work vessels, fleet vessels, barges, and pleasure craft. One man can operate the trailer and tractor. Additionally, the trailer is one of the safest means of moving a vessel up to an upland area. Maneuverability of vessels within an upland area is relatively easy with the hydraulic trailer. An added advantage is that it can be operated on a ramp thus saving the cost of special dock facilities required for tall-legged vessel lifts.

[45] Data gleaned from Pilot House Guide, Alaska Fishermen's Journal, Vol. 23 No. 5, May 2000.

Table 14. Capital Requirement For Vessel Repair

Component	Cost ($)
Site Preparation	75,000
Utilities	50,000
Restrooms	90,000
Lighting	5,000
Fencing	50,000
(1) High Power Wash System	3,500
Waste Oil Disposal Tank (exlcudes opertor)	5,000
Wash down Pad	50,000
Work Station Building	250,000
Trailer and Shipping	200,000
TOTAL CAPITAL	778,500
ANNUAL EQUIVALENT	51,000

Table 15. Annual Cost Associated With A Repair Facility

Associated Cost	High Cost Estimate ($)	Low Cost Estimate ($)
Annual Insurance	17,000	3,500
Manager Salary	45,400	22,000
Office equipment Rental	5,000	No fee
Land Lease or Rental	0[1]	0[1]
Maintenance/Repairs	20,000	12,000
Annual Capital Cost	51,000	51,000
Total Annual Associated Cost	138,400	88,500
MEDIAN VALUE	**113,400**	**113,400**

[1]Land use is unchanged from w/o project condition.

10.19 Repair Facility Revenue Assessment

The revenues from the proposed facility are a function of the number of vessels that can be accommodated at the facility. The number of vessels, which can be accommodated, is both a function of potential demand or market size, and the number of vessels, which the proposed vessel facility can accommodate. Potential market demand exists according to market survey results. The facility capacity is thus the underlying determinant of revenue. The site is ½ acre, which has been proposed for the development of the facility. An estimated 10 vessels can be stored on ½ acre and an estimated 30 to 60 vessels can be accommodated on a 1½ to 3 acre site.

In order to explore the economic viability of a local repair facility, the lift revenues have been estimated according to various levels of use. Based on average number of lifts per hydraulic trailer or vessel lift at other facilities, and potential demand, the facility should be able to ultimately handle 100 to 500 vessels a year, providing workspace is available to handle the vessels on dry land and adequate moorage is available. To determine a hypothetical break-even level of operation, estimates have been based on high, medium, and low lift volumes. The revenues are based upon a 42 ft average sized vessel with charges of $7.00 per ft round trip plus $50 for blocking.

Table 16. Break Even Analysis

Revenues	Low	Med./Low	Medium	Med./High	High
Vessel haulouts	100	200	300	400	500
@ $7.00/ft (42 ft)	$29,400	$58,800	$88,200	$117,600	$147,100
Sheltered work space at $100 per vessel day	400 vessel days = $40,000	$40,000	$40,000	$40,000	$40,000
Blocking	$20,000	$40,000	$60,000	$80,000	$100,000
Facility Storage @ $5.00/ft/mo					
Number of vessels	10	45	60	80	100
Amount	$25,200	$85,000	$113,400	$151,200	$189,000
Total Revenues[1]	**$114,600**	**$223,800**	**$301,600**	**$388,800**	**$476,100**
Expenses					
Management	$45,000	$45,000	$45,000	$45,000	$45,000
Maintenance	$15,000	$15,000	$15,000	$15,000	$15,000
Insurance	$12,000	$12,000	$12,000	$12,000	$12,000
Capital I&A	$51,000	$51,000	$51,000	$51,000	$51,000
Total Expenses[2]	**$123,000**	**$123,000**	**$123,000**	**$123,000**	**$123,000**

[1]Revenues should be regarded as an understatement. They do not include charges for electricity, wash down, inspection, work pier moorage, garbage, or security. As a basis for comparison, a recent market analysis for a travel lift at Port Townsend estimated income in excess of $800,000 for 100 lifts per year. Three other west coast repair facilities with lift capacity ranging from 88 to 100 tons reported revenue of up to $4.9 million in 1994, according to Dunn and Bradstreet. It was concluded that the facility would be viable at the smallest scale investigated despite the negative cash flow.

[2]As facility activities get busier the increment of income from sales and service liquidates the incremental cost of servicing the added units. This self-liquidating aspect of the business activity is a local economic effect, not an NED effect. In this NED analysis the self-liquidating expenses of the operation are displayed as constant at varying scales.

10.20 Vessel Facility Operating Practices

Customers must make reservations 6 to 18 months ahead of time for haul out at competing facilities. Some advance reservations are made to carry out routine maintenance and are scheduled during an off-season period. Since there is an economic incentive to keep the vessel in the water during potential open season periods, demand for facility services are heavier during the off season. After the appointment is made, and even if the customer arrives on time, he often runs into waiting because of delays finishing up vessels already in the facility. Many of the competing facilities have limited storage space and must keep vessels in the haul-out facility while work is being performed. A major advantage of hydraulic trailer lifts, such as the one planned at Saint Paul, is that they can haul a vessel and move it to a work area and be available for other lifts.

Versatility of the lift is limited, if there is inadequate facility space to store vessels, or if there is inadequate dock space to tie them up while the in-water phase of repair is being completed. At Saint Paul, there will be adequate facility space where a hydraulic lift could be used to dry dock up to 10 vessels.

The theoretical daily capacity of the hydraulic lift (potential 24 hour operation) is based on it being comfortably and safely able to allow 8 haul outs per day or 2,160 annually, while allowing for 95 days of downtime due to weather, equipment repair, holiday closures, etc. Using present facility workdays at other facilities as a proxy, there would be about 240 actual lift workdays during the year, and generally one shift per day. In practice the lift is easily capable of 3–4 haul outs per day. So the theoretical limit at Saint Paul under current policy and practice in the industry would be about 720–960 lifts per year providing demand is present. However, the congested harbor and lack of dock storage area will not allow either of the above capacities to be reached. Without a storage area and some moorage expansion, a hydraulic lift will not add any capacity.

Based on discussions in 1998 with four independent vessel repair facilities, common facility practice is to put vessels into the water as soon as possible after work requiring dry land storage is completed. This immediate return to the water is a practical requirement for all vessel facility operators, because hulls are stressed very differently out of the water. Work such as alignment of shafts and other mechanical connections can cause serious damage if done in dry storage. Without in-water storage for vessels to be finished off, overall facility throughput rates are constrained.

An industry rule of thumb is that the amount of time a vessel is in the water during repair is at least equal to the time spent out of the water. There is a wide variation in time requirements, and in some cases, such as for routine inspection or bottom cleaning, the work time needed while the vessel is in the water is zero.

In 1996, Natural Resource Consultants of Seattle did a west coast facility study. The study disclosed that commercial vessels waited between 1 and 3 months for service during the peak period at one-third of the facilities. Some of the facilities require scheduling up to 18 months ahead of time and others as little as 6 months. Without advance scheduling a vessel seeking repair at the peak of the season might find itself waiting three months to a year. Advance scheduling, however, is a rule in the industry. The waiting happens even with advance scheduling of all jobs, because jobs often are more complicated and time consuming than originally thought. Therefore, the facilities with typically the more straightforward and routine maintenance jobs have the least waiting time. These facilities are comparable to the type of facility services planned for Saint Paul. To the extent the addition of moorage at Saint Paul can reduce service delay and trips to alternative ports, there is a NED benefit.

10.21 Competing Facilities

The Saint Paul facility will compete against other facilities able to haul-out and service vessels up to 150 tons. Only the facilities with rubber tired lifts, similar to the one planned at Saint Paul, offer the flexibility to move vessels into and around a work area, taking advantage of available land storage space. There are sixteen such lifts in the state, including hydraulic trailers and travel lifts.

Outside of Alaska, mobile lifts are more common. The 1996 NRC report identified 33 facilities with lifting capacities over 70 tons in Washington, including two travel lifts. There are ten lifts over 70 tons in Alaska, including five travel lifts. Oregon has ten lifts over 70-tons, including one travel lift. So of a total of 53 west coast facilities having lifts over 70 tons, there are eight travel lifts offering capability similar to the 150 ton capacity lift planned at Saint Paul.

With regard to competitiveness, location of the facility is generally not important. Owners are willing to travel great distances to seek satisfaction in three other areas:

- Quality of work.
- Availability of supplies and contractors.
- Satisfactory scheduling and turn around time

Price is also not a primary consideration. Not only will owners typically travel great distances for service, but also they will do so knowingly passing up cheaper facilities on the way.

10.22 Delay Analysis

In this analysis, a 3-month maximum wait was established. In other words, the facility and its in-water work locations will accommodate vessels until average waiting time is equal to 3 months. There is a practical limit to the facility capacity, because within the market area, there are more vessels needing facility service than the facility can accommodate. If a 3-month wait is expected, customers will travel to an alternate facility.

NED benefits are earned from reduction of travel to other facilities outside of the Saint Paul area. A simple queuing model was developed to estimate waiting time with no additional in-water storage space (without-project condition). Appointments were on a random basis, in the sense that, customers were scheduled to arrive at a specific time, but the amount of time required for the work was assigned based on sample dwell time data at other facilities as summarized below:

Percentage	34	24	14	18	10
Days	4	10	30	45	60

In the model, all facility spaces were vacated as the jobs were completed. Vessels were moved into a water storage area where they were kept for a period equal to the dwell time. Delay time was counted for vessels that occupied the facility after dwell time was complete but could not be moved into water storage, because all spaces were full. This simulation was applied only to analyze what would happen in terms of delay, without a new small boat harbor, but with a repair facility and haul out in place. The purpose was to judge the appropriateness of using average data for evaluation of the with-project condition and to provide a basis for adjusting data based on results of the simulation, if indicated. Indications were that averages underestimated total delay and overestimated capacity by about 60%, because as the queue built to approximate 3 months, it became cost effective for new customers to seek service elsewhere, and they were taken off the queue.

A simulator identifies grouped arrivals and departures that are ignored if average daily traffic is used. For example, if average daily arrivals are two per day and departures are two per day, there will be no waiting. But a simulator might select six vessels to arrive in a day and one to depart, putting five in the queue. The difference in approaches, however, does not seem to significantly affect the estimate of throughput capacity, because residual demand indicates the facility is always full. In addition, vessel turnover is a function of available waiting area not waiting time. Since the benefit analysis was based on savings related to throughput, the simulation did not enter the picture except to put an emphasis on the need to limit average delay to 90 days. It was therefore discarded in favor of a simpler static approach.

The stochastic approach inputted a specific number of potential customers, a fixed number of dry land workspaces, and varied the number of moorage/storage spaces. The procedure used a weighted average dwell time of 22 days and calculated average waiting time. Waiting was based on total vessel workdays needed, plus the difference between facility dwell time in terms of vessel days, and post-repair storage available in terms of vessel days. For example in the present without-project condition, 10 storage spaces will produce 2,400 storage days during a 240-day period. Full use of the facility will require an equal number of post-repair storage spaces of which none are available. During the 240-day period, each of the 10 storage spaces can accommodate about 11 vessels for a total potential throughput of about 110 vessels. However, the 110 vessel potential cannot be met, because there will be no storage as they are moved back into the water. There will be 10 vessels stranded in storage and unused throughput capacity of up to 100 vessels.

Every moorage space that was added, increased throughput by up to 11 vessels. Adding three transient moorage spaces enabled the facility to reach a maximum throughput of 33 vessels annually. Ten moorage spaces are needed to allow the facility to reach a break-even operation. With 10 transient spaces, the facility will be able to service 110 vessels a year.

Based on statements from 138 vessel owners operating in Alaska, 43% find it necessary to take their vessels to facilities in Oregon and Washington for service. The balance use Alaska facilities. These statements were made to University of Alaska (U of A) interviewers assessing repair practices of vessel owners in 1996. The U of A study was concerned about planned improvements at Wrangell and was conducted with assistance from the City of Wrangell[46]. There is no comparable data available for Saint Paul. At the Port of Dutch Harbor each year, there are 75 vessels turned away due to lack of moorage that look for space elsewhere. They seek moorage at King Cove and Sand Point, and ports along the Pacific northwest (PNW). Out of the 75 vessels, 56 vessels (75%) find it necessary to travel to the PNW.[47]

Due to lack of comparable data sources specifically for Saint Paul, University of Alaska work was used as a basis for assumptions about the effect of moorage and facility expansion elsewhere in Alaska. The study was for assessment of repair practices statewide, but before using assumptions derived from the U of A work, we verified our intentions with industry sources. We contacted the Fishing Vessel Owners Association (founded in 1914), and United Fishermen of Alaska (founded in 1974), which together represent over 18,000 fishermen. They were asked if expanded moorage and amenities, including haul out and repair, were to be added in Alaska what portion of new customers would save trips to the PNW. One offered that a 50% trip saving to the PNW would be an accurate estimate, and the other estimated

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[46] Christina A. Young, Research Assistant, and Carol E. Lewis, Professor of Resources Management, School of Agriculture and Land Resources Management, Agricultural and Forestry Experiment Station University of Alaska Fairbanks, with funding by University of Alaska Center for Economic Development, City of Wrangell, and Agricultural and Forestry Experiment Station, 1996.

[47] Personal communications by District staff developing an economic analysis of proposed harbor improvements at Dutch Harbor in 1999.

that trip saving to PNW facilities would be realized by more than half the new customers. Both of these are higher than the 43% estimate derived from the U of A data.

Given a with-project throughput of 111 vessels serviced in a typical year at Saint Paul, the lower estimate associated with the U of A data indicates 48 customers will save the time and cost of a trip to Washington or Oregon facilities. Trips to Alaskan facilities would be saved by 63 vessels. In the without-project condition the cost of vessel repair trips to Oregon and Washington is (48 trips x 400 hours per round trip x $38 weighted average hourly cost of the fleet = $729,600.

There are 14 locations in Alaska, which serve as alternative haul-out locations for vessels up to 58 ft and which offer hull, machinery, electronic, and hydraulic repair facilities. They are Anchorage, Seward, Valdez, Kenai, Homer, Sitka, Petersburg, Ketchikan, Juneau, Kodiak, King Cove, King Salmon, Dutch Harbor, and Sand Point. All of the harbors are wait listed. These locations vary in distance from 300 to 1,300 miles. The largest, most versatile haul outs are at Seward, Valdez, and Homer. These three facilities have respective distance from Saint Paul of over 1,000 miles (average round trip distance of say 2,000 miles). In the without-project condition, trips to Alaska facilities will cost (63 trips x 200 hours per round trip including trip preparation x $38 average hourly cost of the fleet = $478,800. We discounted the estimate to zero due to the uncertainty of trip length and frequency.

Under the with-project condition, at least 75% of the customers will still need to travel to Saint Paul from other locations, including Dutch Harbor, False Pass, King Salmon, King Cove, Port Heiden, Nelson Lagoon, Akutan, Nikolski and several smaller villages in the Yukon Delta. With an average round trip travel time of 60 hours in the with-project condition for 75% of the customers or 83, the travel saving of using a repair facility at Saint Paul is ($729,600–$189,200 = **$540,400** providing that moorage, dry storage, or some other means of keeping vessels in the queue is available. This benefit estimate discounts benefits for saving trips to other Alaska facilities, due to lack of supporting data, although it is obvious that service must be obtained somewhere.

There is no moorage contemplated specifically for vessel repair, however, the new marina will include an expanded heavy-duty haul out. As vessels arrive they will be immediately hauled out and moved to an interim storage area near the Post Office. When facility space is available, they will be moved to the facility or work building. Vessels being returned to the water will be able to tie up temporarily at the auxiliary dock on the breakwater or at the space provided for transient customers. Some customers will opt to keep their vessels in dry storage at Saint Paul until they are needed again for the harvest.

The strategy of immediate haul out and storage for arriving customers, coupled with allowing the final stage of work to be done at the transient or auxiliary dock, provides the equivalent of 10 spaces. Allowing for more than 10 spaces is impractical, because beyond 10, the facility throughput will be a benefit only if facility spaces are expanded as well. Therefore the benefit function for moorage spaces is linear, but the related cost curve must capture incremental cost of facility expansion. In this report only one scale of facility development (the break even facility size defined as an annual throughput of 111) has been evaluated, and costs have been included as associated cost.

The next least costly alternative, of getting a vessel to the Puget Sound area from the eastern Bering Sea, is aboard one of the freighters operated by Western Pioneer. Rate data from the company (dated 1996) shows $2.31 per 100 cubic ft or per 100 lbs, whichever is the larger. In 1996, the cost per vessel would have been estimated from $10,000 to $70,000 each way, depending on the size of the vessel being shipped. Adjusted to year 2000 values, the cost per customer would range from over $13,000 to over $90,000. Making the trip under the vessels own power is the least cost solution in all cases.

10.23 Port Opportunity Cost

The city's land use plan shows only a small portion of the island is available for potential development, and most of the developable area has already been improved. Some valuable port lands are tied up because the local fleet is required to be stored out of the water. After a harbor is built the fleet will be accommodated in the water most of the year and formerly used port lands will become available for other income producing activities. To a certain extent this results in a net economic gain. The principle that allows us to quantify this as a benefit also leads us to recognize that lands consumed by the project are an economic cost that must be included in the NED analysis. Ordinarily lands are included in the cost estimate as financial outlays, but larger scales of this project will consume navigation servitude lands, the value of which will escape the formal estimate prepared for tracking financial cost. In the economic analysis these navigation servitude lands are estimated to have a value, based on their use in the without-project condition; hence they become an economic cost of the project.

In the without-project condition, storage of 26 vessels, trailers and gear takes about one acre, year round. In the with-project condition, the fleet expands to 60 vessels including 36 that are larger sizes. If the entire fleet is hauled out due to freeze-up in the with-project condition, it will take a layout space of up to 3.8 acres for up to three months. The layout assumes an access lane at one side and a shared gear storage area at the other side of each vessel, plus access at the front and rear. The number of vessel storage acre/months is practically the same for the with-project and without-project conditions. However, the with-project condition enables the storage to be on lower valued lands.

Presently vessels are stored on cradles or trailers tying up land needed for highly valued marine services. Vessels are stored in small groups where land is available at the waterfront. They are parked in ways where it is often not possible to access a vessel without moving others.

Lease information indicates that annual lease values of bare industrial land in the harbor district ranges from $214,000 per acre per year ($.41 per ft^2 per month) to over $393,000 per acre per year ($75 per square ft per year). The basic storage rate for authorized port storage is $.75 per ft^2 per month and for secure inside storage, $.95 per ft^2 per month. Open, unlighted, unfenced, non-patrolled areas far away from the harbor district can be leased for as little as $52,000 per acre per year.

Lease values appear abnormally high, but they have been verified by review of actual lease information. One lease is held to reserve port land for future use. The location of Saint Paul is so unique it provides promise of exceptionally high profits to harvesters and processors. It is the high profits and limited land area that combine to justify extraordinarily high lease values.

Some port lands are under the control of the TDX Corporation, a Native Village Corporation under Alaska Native Claims Settlement Act, and the City of Saint Paul. All of the CBSFA vessel owners are in “shareholder” families, and as such, they do not pay to have their vessels stored on the TDX land. Tanadgusix Corporation officials are aware of the opportunity cost of storage areas, used by shareholders, is measurable in terms of what the storage areas would otherwise earn. Some of the vessels have been stored on the most valuable lands in the harbor district.

This report has assumed that by project year one, the fleet will be moved to the least cost storage area that can be made secure and convenient with appropriate utilities, and that the economic cost of the area can be represented by averaging the two least expensive storage options, or about **$133,000** per year. A second choice is to assume half the fleet will be stored at the least cost location, and half at the second least cost location, but the results are the same. In the without-project condition, high valued lands will continue to be used for storage. The difference in annual land lease cost for storage of the existing fleet with the 30-vessel harbor, compared to without it is $260,000.

Alternative plans that consider expansion beyond 30 vessels require navigation servitude lands, having a high opportunity cost. The value of these lands is not recognized elsewhere in this report so is treated as a non-monetary economic cost in this aspect of the economic analysis. This non-monetary opportunity cost effectively cancels out much of the economic gain of using less valuable lands for storage. At the scale of a 60-vessel harbor, the economic cost of the navigation servitude lands is so high as to reduce the overall gain, in terms of port land use opportunity cost, to **$20,000** annually. For alternatives larger than the 60 vessel harbor, the benefit becomes a net opportunity cost. At the scale of the 90-vessel harbor, the annual economic loss is $943,000 annually.

10.24 Opportunity Cost of Launch and Retrieval

Launching is done with a crane, and on occasion, with a large wheeled loader. Cost of using the equipment is $100 per hour for the loader and an operator, and $240 per hour for the crane, including an operator and volunteer spotter. Use of the loader is ordinarily avoided by the fishermen because the channel at the put-in point is narrow with rock shoals that are difficult to avoid, even when the tide is not running, and winds are light. Each year several outdrives are damaged, and at least one vessel has been sunk. The launching and retrieval often demand the attention of six people for a single vessel. Labor cost is a flat charge of $50 per hour, and any equipment fees are additional and are based on current rental Blue Book rates.

A new heavier capacity crane with extended reach will be needed to lift larger vessels, coming in to work the CDQ crab fishery, and hourly rates are anticipated to be higher. For this analysis it is assumed each vessel will be put in and taken out six times during the year; the crane, one operator, one spotter, and two persons aboard the vessel can handle one vessel every 45 minutes; and it will take 2 hours to service, warm, and relocate the crane.

Skippers must use valuable weather windows for launching and retrieval. Fishing for subsistence and for commercial purposes is interrupted, and to a great extent limited. Because of the need to wait on availability of a crane or loader, and the fact everyone rushes to launch and retrieve within a limiting weather window, each launch can take 2 hours and 45 minutes of crane time for the first vessel and 45 minutes for each additional vessel, for a total crane time of 22 hours to service the 26 vessel fleet. At an average opportunity cost of $240 per hour, without the project, there would be seven round trips for storm protection over a period of nine months at an annual cost of $73,900. With the project, a hydraulic trailer will be used instead of a crane. Only one haul out each year will be required taking a half hour per vessel also at an hourly cost of $240, for a total fleet cost of $3,100. Annual savings are estimated to be **$69,800** for the 26-vessel fleet.

For unpaid hourly labor, the total time for launch or retrieval of the fleet is estimated to be 22 hours, and from start to end, each vessel ties up three, two or three crew persons for $275 for the fleet. The project will reduce these events by a net of six round trips per year, labor requirements will be reduced to one person, and launch time to 15 minutes, saving about $200.

10.25 Transportation Savings For Disabled Vessels

Presently vessels over 32 ft, which are in need of repair, must be towed to Dutch Harbor. Saint Paul does not have adequate haul-out facilities, crane capacity, or dockside work area for repair crews to fix larger vessels. Each year there are 5–10 vessels that must risk the open water trip to Dutch Harbor for repairs, and frequently, the vessels must be taken in tow for the entire trip. Sometimes the owners elect to return vessels to Seattle where they contract with the manufacturer for repair. Manufacturers typically accommodate distant water operators with added flexibility, because they prefer to service vessels they produce. Vessels have sunk on the way to Dutch Harbor, because it was not possible for them to be repaired at Saint Paul.

It takes time to arrange for a tow thus adding lost income to the financial damages. The Ocean Challenger was in the harbor 3 months, Smokey Point 2 months, and the High Seas 6 months. Since there is typically no harbor space available, disabled vessels need to be moved daily to minimize interference with processor operations. Numerous other vessels have been towed into Saint Paul disabled and have had to wait shorter periods for a tug.

In addition to the lost harvest time and added travel cost for repairs, there are adverse impacts on processing operations. Processors contract with harvesters to keep the production lines going. When the raw material flow is interrupted, the economics of the processing operation grow less profitable. Benefits associated with preventing the negative impact on processor operations, or lost harvest time of the vessels, or lost earnings of the crew, were not estimated.

Since there is not an ocean going tug stationed at Saint Paul, one must make the trip from Dutch Harbor to take the disabled vessel in tow. The cost of a tug for the round trip is $466 hour cost at sea x 550 miles/6.5 knots = $39,600. Benefit of preventing five events per year is $198,000, and for 10 events, the benefit would be $396,100. For purposes of this report, average number of trips reported during the last three years is five. Benefits for this category are **$198,300.**

10.26 Harbor Congestion

Without a small boat harbor, the deep-draft part of the harbor is used for offloading catch from the small vessels. This requires them to tie up at spaces reserved for deep-draft vessels. The large commercial vessels have a priority of use and frequently displace the small fishing vessels.

The outer harbor is typically very busy with vessels waiting outside to get in. During a sample period of 300 consecutive days, there were 1,680 users. The average time at the dock face was 8 hours. This included 56 vessels that were in need of maintenance, damaged, or disabled. There is no recorded data, showing the number of times that smaller vessels were either displaced or forced to wait, until a larger vessel had finished its business and departed. Discussions with the local fishermen indicated this was a daily occurrence, during times when the fleet was most active.

A benefit for alleviating congestion was not estimated because of the huge uncertainty in the amount of time lost and number of occasions. To some extent the cost of the delay reduction is already measured in other benefit categories. The beneficial effect on large commercial vessels that use the outer harbor on a priority basis has not been quantified, however, it is an overall net gain in benefits to them. It was concluded, however, that a small boat harbor is consistent with the needs of the outer harbor and will increase efficiency to all users.

10.27 Reduced Harbor Dock Maintenance Cost

When storm conditions cause wave activity inside the harbor, floating docks, used for temporary tie ups for the small vessel fleet, are required to be removed. The crane lifts the three approximately 60 ft units from the water and stores them alongside the waterfront at a documented cost per event of $30,000, not including the opportunity cost associated with storage of the dock units on valuable industrial land. During an assumed “normal year” this removal activity will take place one time. The docks will be due for replacement by project year one, and estimated cost by that time will exceed the $215,000 originally paid. Annual savings from eliminating the need to remove the docks and the annual savings in replacement cost total **$48,100** annually.

10.28 Improved Subsistence Fishery

Weather conditions limit the time the local fleet fishes, and each hour saved in the launch and retrieval process is an hour of additional harvest time for the subsistence fisheries. There is considerable room for expansion of local fleet activities, and local fishermen have stated a small boat harbor is needed so they can increase their subsistence harvest.

For the Aleutian Island area (ADF&G, 1994), data reveals average per person subsistence harvest is 378 lb per year. At Saint Paul it has been 267 pounds. Alaska’s highest per capita subsistence harvest is at Hughs, where it is 1,498 pounds. A study by ADF&G in 1989, Alaskan’s Per Capita Harvest of Wild Foods, summarized the following as factors accounting for some communities having extraordinarily high per capita consumption rates:

- The subsistence harvest is high, because it is used as a substitute for milk products (the single largest item in the American diet), fruits, vegetables, and grains. In the U.S. average meat and poultry consumption is 255 lb per year, but in Saint Paul, the subsistence harvest also provides clothing, home goods, trade, ceremony, arts and crafts, and other uses.

- Native communities harvest more wild foods than communities with higher non-Native populations.
- Generally, harvests increase as the distance from road systems increase.
- Because of the high cost of transportation and storage, store bought foods in rural areas can be expensive, and many choices are very limited.

A survey of the community by ADF&G revealed that 89% of the people are involved in subsistence harvests, but 99% use subsistence resources. Pressure on harvesters is indicated by 1994 ADF&G statistics, which reveal over 14,000 lb of halibut were removed from the commercial harvest to be used for subsistence purposes. This is an indication that fish, which the islanders harvested for commercial purposes, were more valuable to the islanders for subsistence use. There is an obvious unmet need for subsistence harvest.

For purposes of this analysis, discussions with residents support the assumption that the community would harvest at least enough halibut to bring the community subsistence harvest up to that of other Aleutian villages. Subsistence harvests by residents of Akutan, Atka, False Pass, King Cove, Nelson Lagoon, Nikolski, Sand Point, and Unalaska were used to establish an average harvest level. Based on this baseline, the Saint Paul harvest would be an increase from 267 to 378 lb per year for the 492 subsistence harvesters on the island, merely to equal the average for the Aleutian area. The highest per capita subsistence harvest was at Nikolski, 550 lb per person, and the average per capita harvest of the highest four villages (Akutan, Atka, False Pass and Nikolski) in the sample was 470 lb per person. A projected harvest of 470 lb at Saint Paul would put island residents equal to the average of the top quartile but at only 85% of Nikolski, the top harvester.

This is a total increase of 99,900 lb for all Saint Paul permanent residents. Studies by ADF&G use replacement food values for subsistence harvest in the \$3–\$5 range. Using \$4.00 per pound, the value of the increased subsistence harvest is **\$399,600** annually. It is neither gross value nor net. It is an implied value from secondary sources. The value is not directly supported by a market because it is a subsistence value estimate that does not necessarily bear a relation to market value of commercially caught fish, or the cost incurred in getting them. Food is an important use of the subsistence harvest, but there are other important uses including clothing, home goods, ceremony, trade, and arts and crafts. These other uses are not recognized in the value of commercially caught fish. For example, persons with resources to trade frequently have advertised wares on area radio programs. The following is a sample of such advertisements made on the Kotzebue Swap-N-Shop program. The list would translate roughly to \$11.00 per pound.

- Gunny sack of whitefish, \$1.00 per pound.
- Five to six pound blocks of black muktuk for sale at \$15.00 per pound.
- Plain seal oil for sale, \$2.00 per pound.
- Dried ugruk meat, \$3.50 per pound.
- Paniqtuq mixed with cooked meat, \$2.50 per pound.

- One whole ugruk skin for mukluk bottoms, $105.00.
- Beluga muktuk for sale, $4.00 per pound.
- Blueberries and cranberries for sale, $100.00 for 5 gallons.
- Five marten skins for sale from Huslia, $50.00 each.
- One large dark wolverine skin with long hair for sale, $500.00.
- 70 muskrats from Noovik for sale. Also a wolf and wolverine skin. (no price mentioned).

We have no basis for estimating the cost of taking the subsistence harvest. However, our largest concern with a “netting out” of cost is that we feel the estimate is already a serious understatement. This concern is based on the fact that we have totally discounted the NED “existence value” of the experience itself. We would argue that the experience should be viewed as a benefit instead of a cost. It is possible that even the $11 per lb tallied from the above could be a serious understatement. We used $4.00 per lb and are reluctant to validate that figure by making harvest cost adjustments to it.

Table 17. Benefit Summary

(Costs, thousands)

	30 Vessel Fleet[1]	50 Vessel Fleet	60 Vessel Fleet	90 Vessel Fleet
Prevention of Damage	12.3	27.1	127.9	188.7
Prevention of Theft Loss	5.0	11.0	52.0	76.7
Prevention of Vandal Loss	2.0	4.4	21.0	30.9
Harvest Cost Reduction	168.8	287.1	360.3	360.3
Delay Prevented by Water taxi Service	80.0	80.0	80.0	80.0
Transportation Savings for Scheduled Repair	0[4]	540.4	540.4	540.4
Port Land Opportunity Cost[5]	260.0	162.6	20.0	(943)
Vessel Haul Out	69.8[3]	69.8	69.8	69.8
Transportation Savings for Disabled Vessels	0[2]	198.3	198.3	198.3
Dock Maintenance	48.1	48.1	48.1	48.4
Subsistence Fishery	399.6	399.6	399.6	399.6
TOTAL	**1,045.6**	**1,828.4**	**1,917.4**	**1,050.1**

[1]The 30 vessel fleet is the existing fleet but with 4-5 vessels in the 30–40 ft class as replacements for some of the smaller vessels. It is derived in the fleet projection part of this report in that it is consistent with-projections for the halibut fleet. The 30-vessel fleet is included at the request of the project sponsor.

[2]Transportation benefits would not exist because the small harbor would not accommodate vessels significantly larger than the existing fleet. Vessels larger than 32 ft would still be towed to Dutch Harbor for repair.

[3]Only 4 vessels in the 30-40 ft range would be long season fishers. The rest of the fleet is too small to safely fish anything but months of summer. In the without-project condition they could be left in the water at the city temporary dock but would need to be hauled out often to prevent damage from minor storms.

[4]Inadequate moorage to accommodate the transient customers necessary to support a break-even operation.

[5]Some benefit is associated with freeing up valuable land used for marine storage, but larger projects require additional high valued navigation servitude lands otherwise not recognized as a cost.

11.0 COMPARISON OF ANNUALIZED BENEFITS AND COSTS AND IDENTIFICATION OF NED PLAN

Benefits were estimated for four different fleet sizes and configurations: 30 vessels, 50 vessels, 60 vessels and 90 vessels. Fleets of the different sized harbors are characterized as follows:

- 30 vessels, primarily a halibut fleet in the under 32 ft class with most of them in the 20–30 ft class. Vessels under 26 ft are considered trailerable and are primarily subsistence fishers.
- 50 vessels, which include most of the above fleet and the addition of vessels on the 40–58 ft class, with most of the larger class vessels being close to the lower end of the 40–58 ft range. The fleet would target halibut and cod within 15 miles of the island.
- 60 vessels, which include the day use halibut fleet plus a larger fleet of primarily 40–58 ft multi-use vessels. During most of the year, these larger vessels would be capable of targeting all species available to the island. They would be the primary wintertime crab harvesters. Benefits and annual costs for different size fleets are summarized below.
- 90 vessels, which would be the 60-vessel resident fleet with transient moorage for 30 more.

Costs were estimated for harbor sizes scaled to serve 30, 60, and 90 vessels with the same fleet mix as used in the benefit evaluation. Comparison of these cost and benefits are provided in the main report, tables 6 and 8. After that, the annualized cost and benefit estimates for various sized harbors at the South Village Cove location were plotted against each other as shown in exhibit 1. The chart in exhibit 1 illustrates that benefits for all plans, except the largest, exceed costs, and that a project scaled for 60 vessels provides the most net NED benefits. It has a construction cost of $10,445,000 (October 2003 price level). To determine a benefit to cost ratio this cost was deflated to the price level of the economic analysis, October 2001 with an interest rate of 6 1/8%. This provided an annual NED investment cost of $831,000 including an annual operation and maintenance cost of $159,000. Average annual NED benefits are $1,917,000. The project's benefit to cost ratio is 2.3 with annual net benefits of $1,086,000.

Table 18. NED Plan

(costs, thousands)

Fleet	Annual Benefit ($000)	Annual Costs ($000)	Net NED Benefits ($000)
30 vessels	1,046	788	258
50 vessels	1,829	817	1,012
60 vessels	1,917	831	1,086
90 vessels	1,050	919	131

12.0 NED DEPTH

12.1 Depth Requirements

Required depth is determined by draft of the fleet and under keel clearance requirements. Under keel requirements account for extreme low water levels, which are lower that predict lower water levels, squat, pitch roll and heave, and a factor of safety. The under keel clearance assures that the fleet can access the project under all conditions.

Some economic studies of NED depth trade off fleet delay cost against the cost of deepening the project. In some cases, it has been shown that waits will be so infrequent and by so few vessels that provision of an increment of depth is not justifiable. In the case of Saint Paul, waiting was not considered to be an option. The reason is the fleet must be able to shelter without delay due to the sudden arrival of treacherous sea conditions, which could jeopardize human life. This was considered to be an unacceptable and unnecessary risk.

Concerning the depth of the entrance channel, it was necessary to provide a depth of 16 feet. This was a specified hydraulic design constraint on all alternatives. Lesser depths at the entrance could not provide tidal cycle water exchange achieved by the without-project condition. Greater depths were not evaluated in the economic analysis, because the entire fleet would be able to pass unhindered with a 16 ft depth, and there would be no incremental benefits to be achieved.

12.2 Fleet Requirements

The largest vessel anticipated to use the project is 58 ft by 23 ft by 8 ft. There will be 23 vessels over 55 ft but most of them will draft under 8 feet and 13 vessels between 40–55 ft with a draft less than 6 ft. There are 17 between 26–39 ft and 27 under 26 ft, including 20 hand launched skiffs. The under keel clearance needed to assure reasonably safe, undelayed passage on days when harbor water is shallow due to wind and tide, added 4 ft to all of the drafts. Fleet requirements and benefits were therefore expressed as follows:

Table 19. NED Depth

Required Project Depth (ft, MLLW)	Vessel Draft	No. Vessels	Annual Benefit ($000)	Annual Cost ($000)	Net Annual Benefit ($000)
12	8	2	1,917	831	1,086
10	7	21	1,829	812	1,017
9	6	13	1,046	802	244
8	<4	24	797	792	5

12.3 NED Depth

The comparison of benefits and costs for the various depths indicates 12 ft to be supportable as the NED depth. It was not bracketed by a deeper project. It was the maximum depth evaluated, because it accommodates the entire fleet being planned by CBSFA, and the incremental benefit from added depth would be zero. There is no residual delay.

13.0 RECONCILIATION OF FLEET COST AND INCOME

Reconciliation is necessary to demonstrate that the claimed difference between the with-project and without-project conditions is actually achievable. Estimated cost reductions cannot be so great as to reduce costs below reasonable operating levels. Nor can without-project costs be so high as to remove the prospect of profitability. Reasonableness was verified by tallying all of the benefits related to fleet operating cost and added them to the vessel operating budgets to determine if the fishers could actually operate and show profitability in both the with-project and without-project conditions. The following tabulations illustrate the comparisons. It was concluded that the fishers will be profitable in both cases, and the estimated savings are reasonable.

Table 20. Annual Variable Operating Cost With The Project (For Saint Paul Based Vessels)

Class	Fuel, Repair, Maintenance ($1,000)	# Vessels	Cost ($1,000)
0-26	$2.0	27	$56.0
26-39	26.9	17	$457.3
40-55	96.1	13	$1,249.3
+55	124.1	23	$2,854.3
		TOTAL	**$4,616.9**

Table 21. Annual Operating Margin

	Cost ($1,000)
Saint Paul fleet variable operating cost wth-project	4,619.9
Add estimated operating savings	631.2
Estimated operating cost without-project	5,251.1
Operating income	10,900.0
Less: Saint Paul variable cost w/o	5,251.1
Operating margin w/o	5,648.9

Table 22. Total Fleet Budget With-Project (For Saint Paul Based Vessels)

Class	Total Cost ($1,000)	No. Vessels	Cost ($1000)
0–26	10	27	280.0
26–39	92.3	17	1,569.1
40–55	276.6	13	3,595.8
+55	413.6	23	9,512.8
		TOTAL	**14,957.7**
Saint Paul fleet total annual cost with-project			14,957.7
Less: Income at Saint Paul			10,900.0
Deficit			**4,057.7**

13.1 Reconciliation

As can be seen in the above tables, the total cost of the with-project fleet would exceed the gross harvest income, projected earlier in the report if the budgets were not adjusted, or if the predicted harvest were not increased. The indicated deficit is $4,057,700. This would be a matter of concern except that the budgets include the cost of fishing outside of the Saint Paul area without counting the related income. They also allow a generous portion for crew share. The following discussion illustrates that crew share can be cut back adequately to safely make up the shortfall. After that, a reconciliation of cost and income limited to Saint Paul operations is presented to illustrate profitability without adjustment of crew shares.

Reducing the crew share from 50% to 20% is still adequate to allow the higher income threshold of $25,600 to be exceeded. At a 20% level of crew share, the fleet will generate 86,400 person hours of income, and hourly earnings will be $32.80. There will be 42 FTE jobs, and the fleet will cover all fixed and variable cost. Use of crew shares at either 20% or 50% does not change the benefit analysis, because savings were based entirely on variable operating cost.

For the size of vessel anticipated in the Saint Paul fleet, 20% crew shares are generally less than the fleet average for Alaska overall. Data in the Alaska Seafood Industry Study showed average crew shares of 18%, 27%, 37%, 26% for halibut long line under 5 net tons, long line for miscellaneous fin fish, tanner and king crab statewide under 50 ft, and tanner and king crab statewide under 75 ft respectively. Aleutian Island set net and statewide halibut troll operators showed average crew shares of 10% and 3% respectively. When the crab LLP has the intended effect of reducing the number of large vessels, harvest by the crab fishers 60 ft and under will increase. There are no projections available regarding anticipated shifts in the harvest, but the amendment is designed to accomplish this. Since most of the harvest has historically been taken by the large vessels that are going to be taken out of service, the smaller vessels will receive a windfall opportunity. It is conceivable that harvest by vessels under 60 ft will double in a year or two, and 50% crew shares will be easily affordable.

13.2 Matching Costs and Revenues With Season Fished

At Saint Paul as with other Alaska harbors, the permanently moored fleet operates in a number of different fisheries at different locations during the year. The Saint Paul fleet will also be available for other harvests at other locations such as herring and salmon. This is especially true of the larger vessels, expected to be relocated from other ports under new ownership. The vessels will have been active in salmon fisheries and will maintain their permits. Therefore, the income and expense of the Saint Paul fleet should be matched with the days of operating at Saint Paul.

The fleet operating budgets in tables 6, 7, 8 and 9 reflect season operating days unadjusted for days fished out of Saint Paul. The fleet costs, estimated at $4,616,900 and $14,957,900, are therefore overstated, because they include the cost of operating in fisheries away from Saint Paul. If the relevant cost is defined as being related to activities out of Saint Paul, the number of days fished out of Saint Paul must be incorporated into the reconciliation. Limiting the cost and revenue to Saint Paul based activities reduces variable cost and total cost of the fleet to $1,765,000 and $6,317,500 respectively. The operating margin is $8,513,800, and the net income is $3,951,300 with crew shares fixed at 50%.

Table 23. Fleet Budget Variable Costs Limited To Saint Paul Operations

Size Class	Hourly Variable Cost	Trip Hours	Days Fished	Number In Size Class	Fleet Cost
0-26	3	12	14	27	10,000
26–39	32.50	12	22	17	145,900
40–55	53.50	12	13	13	350,900
+55	95.00	12	23	23	1,258,600
				TOTAL	**1,765,000**

Table 24. Fleet Budget Total Costs Limited To Saint Paul Operations

Size Class	Hourly Total Cost	Trip Hours	Days Fished	No. Size Class	Fleet Cost
0–26	6	12	14	27	30,000
26–39	106.40	12	22	17	477,500
40–55	156.80	12	13	13	1,027,400
+55	361.00	12	23	23	4,782,600
				TOTAL	**6,317,500**

Table 25. Income And Cost Limited To Days Fished Out Of Saint Paul

	Variable Cost Analysis ($)	Total Cost Analysis ($)
Income	10,900,000	10,900,000
Fleet cost with-project	1,765,000	6,317,500
Add operating savings (benefit)	631,200	631,200
Cost without-project	2,386,200	6,948,700
Margin	8,513,800	3,951,300

Table 26. Illustration Of Crew Activity With A Hourly Earning Rate Of $32.50

Class	Days Fished	#	Average Crew	Crew Days
0-25	14	27	1	400
26-39	22	17	2	700
40-55	44	13	3	1,700
+55	48	23	4–5	4,400
			Total	7,200
			Multiplied By	12 Hrs
			Grand Total	**86,400**

$2,838,000 reduced crew share/86,400 fishing hours = $32.80 per hour

87,000 hours/2,040 = 42 FTE

14.0 PHASED CONSTRUCTION

14.1 Phased Construction

Phased construction has some significant advantages, which minimizes risk to the sponsor, without foregoing other opportunities and without adversely impacting viability of the project. It is attractive financially as a means of relieving a small community from the burden of major cash requirements, and it allows time for the community to adjust and take advantage of a major change in the heart of the city.

14.2 Economic Implications

Changes will take place rapidly in the fishery now that CDQ and IFQ programs are in effect and a crab LLP has been approved. A phased small boat harbor will allow the community to develop in step with the rate of transition to fishing as a livelihood that residents prefer. It also leaves open the prospect to accelerate expansion as the sponsor may elect to do later. The impact on the benefit cost analysis will be minimal. An initial phase would be comparable to development of a 30 vessel harbor, which displayed a benefit to cost ratio of 1.7:1. Additional phases would improve the economics as increments proved to be better with each unit added. A present worth adjustment to the economics will influence both sides of the benefit and cost equation, hence future additions will also be attractive investments.

15.0 UNCERTAINTY ASSESSMENT

Since this particular project enjoys a very healthy benefit to cost ratio, and since some sensitivity has been demonstrated in the text, this risk and uncertainty discussion was limited to a summary analysis. The summary analysis identified potentially significant areas of risk and uncertainty and associated them with five categories as follows: uncertain, reasonably certain, reliable and supported, analysis used in the report, and high side assumptions. Factors influence uncertainty on the benefit side of the equation in the following areas:

15.1 Development of Saint George Harbor in the Without-Project Condition for Saint Paul Harbor

The neighboring island of Saint George has begun planning a local harbor improvement, which was not specifically included in the without-project condition for Saint Paul. The issue is whether work at Saint Paul would remain justified, and whether the NED plan would be changed by insertion of Saint George in the basic without-project condition. Study of a harbor improvement at Saint George is not yet at the reconnaissance stage. However, it is reasonably certain that improvements are economically justified and that a plan can be implemented there, even after a new harbor has been built at Saint Paul. The scale and timing of the improvement are highly uncertain. The plan formulation and justification at Saint Paul is not sensitive to development at Saint George, because the Saint George Harbor economics are oriented to larger vessels than can be accommodated at Saint George. Economic justification of the harbor hinges on commercial transportation savings for quarry product. In addition, the Saint George Harbor is highly likely to provide harbor development at an incremental cost lower than Saint Paul after the NED scale of Saint Paul has been reached. This will be particularly true for the fleet that is oversized for the Saint Paul Harbor. This makes it an ideal increment of development for the eastern Bering Sea regardless of progress being made at Saint Paul.

15.2 Damage Estimates

Damage data is from persons experiencing damages at Saint Paul. Data is reliable and supported, but it is an uncertain analysis due to hypothesis about damages prevented to vessels, appearing in the with-project condition. In addition, it was assumed damage will bear a relation to vessel and fleet value as the fleet expands. There are no high-side assumptions.

15.3 Vandal Loss

Data is from persons experiencing damages at Saint Paul. Data is reliable and supported, but it is an uncertain analysis due to conjecture about losses experienced in the without-project condition by the vessels that would relocate to Saint Paul. In addition, it was assumed that vandalism losses bear a relation to vessel and fleet value. There are no high-side assumptions.

15.4 Theft Loss

Data is from persons experiencing losses at Saint Paul. Data is reliable and supported, but it is an uncertain analysis due to conjecture about the without-project condition for vessels that would relocate to Saint Paul with the project. In addition, it was assumed that theft loss bears a linear relation to vessel and fleet value. There are no high-side assumptions.

15.5 Water Taxi Service

Prospects for a water taxi service were verified with local interests, who have evaluated profitability of the venture. Data is reliable and supported. High-side assumptions would be linked to choice of simulation model, loading of data, and interpretation of the sample operating data, and to adjust for season closure that would rule out processor deliveries. However, the specific high side variable used in the sensitivity analysis was the $90.00 hourly operating cost of a 90–160 ft vessel waiting off shore at a 50% power setting. A 25% power setting was also presented and is characterized as reasonably certain.

15.6 Port Land Use

The land use plan has status as a local ordinance. Lease values were verified with land owners. Data is reliable and supported. There are no high-side assumptions.

15.7 Haul Out Problems

Problems were taken wholly from first person accounts. Data is reliable and supported. There are no high-side assumptions.

15.8 Dock

Cost and operating practice were provided by the owner. Data is reliable and supported. There are no high-side assumptions.

15.9 Scheduled Repair

Reliance on transfer of data from other studies was necessary. The significant difference in the fleet with the project and without the project creates uncertainty about repair practices. Development of a repair facility at Saint Paul would require significant leadership and innovation, and the time it would take to demonstrate profitability is uncertain. High-side assumptions relate to throughput capacity and vessel transportation cost. Benefits are based on reduction in trips to alternative repair facilities and are considered to be a low-side estimate.

15.10 Verification of With-Project and Without-Project Condition

The without-project condition and problems are the result of testimony at public meetings at Saint Paul. Problems described were verified publicly with the community. The with-project condition is more of a result of engineering judgment, regarding what physical accomplishments are likely to result from a project. The with-project condition is a consensus of the planning team and was coordinated and verified at a public meeting. Although a result of judgment and expert opinion the consensus among parties indicates this to be a reliable and supported estimate. There are no high-side assumptions.

15.11 Exvessel Prices

Annual averages were used to adjust for seasonal and yearly changes in prices. Data is reliable and supported. There are no high-side assumptions.

15.12 Fuel Cost

Fuel sales were sampled on consecutive Tuesdays for the most recent 24-month period. Samples were at Dutch Harbor and Saint Paul. An average value was calculated for all sales at the two ports. Data is reliable and supported. There are no high-side assumptions.

15.13 IFQ as an Incentive for Fleet Development

This is a rational assumption. It was based on data, which showed that concentrations of IFQ resulted in increased net income to harvesters. This is a rational model, and data is reliable and supported. There is no high-side assumption.

15.14 Income Threshold

The level necessary to induce people into fishing as a livelihood is uncertain. One hundred and forty percent of average earned income was used. Use of a lower threshold would encourage a larger fleet. Average incomes in the industry are well below the threshold. This is an untested estimate and could be on the high side. As a high-side estimate, the benefit estimate that was derived from it could be an underestimate. The threshold is based on judgment and is uncertain. The value used in the report is considered to be a high-side estimate.

15.15 Future Guideline Harvest Levels and CDQ Allocations

Ranges, based on the most recent ten years, were used to compensate for the cyclical nature of stock health and harvests uncertainty. The estimate is a solution of convenience, due to lack of other forward-looking estimates. It was based on recent harvest history and is considered reasonably certain, if taken as a general picture of the long-term future. There is no high-side estimate.

15.16 Fleet Structure

This was based on the net income advantages offered by the location of Saint Paul for certain IFQ and CDQ resources. Fleet structure was demonstrated as providing net income to all harvesters. Net income estimates are subject to variation based on vessel production rates and operating budgets. Historical data, based on similar operations was used for net income estimates. Fleet structure is reasonably certain. There is no high-side estimate.

15.17 Vessel Operating Cost

This is a sensitive factor in estimating transportation cost. Documented cost and estimates of other reports were used to bracket costs in this report. Number of trips was coordinated with local operators. Cost estimates are reasonably certain for a multi-species fleet based at Saint Paul, although they would probably not be valid if applied to other fleets at other ports targeting other harvest mixes. A high-side estimate would depend mainly on being able to explain higher fuel consumption rates based on higher power settings.

One significant variable in determination of operating cost is the vessels main power unit and the manner in which it is used. Of equal concern is auxiliary power used to run on board freezers, processing equipment, and generate auxiliary power. Short trips out of Saint Paul will minimize dependence on freezers so the related power plant has not been included in the hourly cost of the with-project fleet. For the Dutch Harbor based fleet operating in the without-project condition, we have allowed for auxiliary power needed for fast freezing, glazing, and on-board processing. The needed power is included in the estimated total vessel horsepower for the larger sized vessel. The generator sets include one 320-kW Cat 3406, one 190-kW Cat 3306, and a 105-kW Cat 3304. The 3406 will run all of the time the vessel is fishing or in route, and the 3306 will run while the vessel is harvesting and steaming back. The 3304 is only used during port stops. The two larger generator sets consume 43 gph, which was included in the average overall vessel consumption rate of 82 gph, noted in the operating budgets.

15.18 Haul-Out Time

This was based on testimony of local fishermen and facility operators. Value of leisure time was based on procedures in prior Corps' studies, and hourly earnings from alternative employment opportunities in the fishing industry. Data is reliable and supported. There is no high-side estimate.

15.19 Subsistence Fishery Evaluation

Basic data was provided by ADF&G. Sources depend on numerous first person interviews and are well documented. Data is reliable and supported. The with-project condition was based on comparison with other similar areas and an assumed value of $4 per pound. State of Alaska studies use $5 per lb to illustrate the value of subsistence to the cash economy of the state. Exvessel values were not used, because subsistence patterns reflect needs extended beyond an alternative food source or diet supplement. Since this is a non-market based value estimate and the analytical methods are not well developed, the value estimate is considered reasonably certain. High-side estimates would apply to value per pound.

15.20 Intended Affect of CDQ and IFQ on Spreading Out of Harvest Periods

The result would be to allow Tanner Crab harvest during periods of favorable weather. This is consistent with historical harvest during the 1970s but not consistent with recent openings. Biological criteria and market aspects were not investigated. The intended effect is uncertain, however, the impact on the benefit analysis is of no consequence.

15.21 Use of Opportunity Cost as a Basis for NED Benefits of Harbor Improvements

This issue crosses over between interpretation of agency policy and guidelines. The different possible interpretations can result in a major impact on the benefit analysis. For this report, low-side assumptions and interpretations were used. This is an overarching issue and is considered to create a benefit evaluation that could be considered to be uncertain. Although uncertain, it is also self-mitigating, in the sense the bias is to the conservative side. The issue is whether one uses out of pocket costs, (short-run variable cost) or opportunity cost (long-run incremental cost) to measure economic cost. A high-side estimate would depend on being able to apply long-run incremental cost to determine transportation cost.

Corps' guidance indicates that when dealing with NED analysis of transportation, the Corps is supposed to be estimating the difference in cost of delivering a commodity[48] For the NED analysis of harbor improvements that benefit commercial fishing, one looks into the difference in cost of harvest[49] Analysts should not assume costs are limited to differences in short-run variable cost outlays of the harvester. From the NED frame of reference, capital costs are a necessary input to estimating hourly costs[50] To the extent capital costs are affected by a project they are a NED consideration[51]. This would imply that hourly cost of vessels should be estimated using opportunity cost consistent with Corps' source documents (These documents describe derivation of hourly or daily costs of vessels and other types of equipment while concerning themselves with both fixed and variable costs.). Some of the source document methodologies reduce all costs of ownership and operation to daily or hourly equivalents because more than hourly variable costs are required to make the entire bundle of resources embodied in the vessel or equipment available.

The total value of the bundle of resources tied up in the vessel has an hourly equivalent that must be accounted for. The reason is that the opportunity cost of taking a vessel out of productive use is the income it might otherwise be earning, and the minimum income it would be expected to earn in the long-run, would have to be at least equal to all of its costs. The cash savings from an hours worth of vessel time is based on variable cost, however, the opportunity cost would reflect that if you save an hour worth of wear and tear now, you essentially extend the useful earning life of the vessel by that amount. One hour of life added to the vessel would be measured by total cost not just variable cost.

An hour's loss of production time has to be at least equal to long-run marginal cost. The cost of a vessel owner to lease a similar vessel would include the hourly equivalent of fixed and variable cost. That is the cost the owner must recover to remain viable[52]. Hourly variable costs make up only 26%–34% of total hourly costs. It may be appropriate to use total hourly cost as an estimate of hourly opportunity cost in some parts of this study. The implication to this study is that NED benefits may have been somewhat understated by reliance on variable cost as a substitute for opportunity cost in all cases.

15.22 Basis for Opportunity Cost

NED guidance and economic literature in general supports the concept that economic cost and opportunity costs are equal. Guidance supports the proposition that effects on the nation are to be evaluated. Corps' studies use long-term planning periods and their end result is a

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[48] Published paper version of Economic and Environmental principles and Guidelines for Water and Related Land Resource Implementation Studies, (P&G as presented in Corps of Engineers ER 1105-2-100, paragraph 6-59, 6-75).

[49] Ibid Para 6-117.

[50] Ibid, Para 6-59 a. ."the benefit is the reduction in economic cost of using the waterway.", and para 6-117"…Harvest costs include…cost of equipment ownership and operation…"

[51] Ibid 6-117, …The NED benefits are conceptually measured as the change in consumer's and producer's surplus as a result of a plan."

[52] See appropriate Planning/Economic Guidance Letters for a breakdown of total cost to daily equivalents for the deep-draft vessel fleet, inland waterway tugs and barges, and appropriate EP for illustration of the methods used to derive cost of other tug and work-boat equipment cost. See IWR Report 91-R-11 for a good discussion of opportunity cost.

capital investment decision, therefore use of long-run costs are appropriate in NED analysis. When referring to cost effects on net income, it is not costs that are relative to the fisher or to the shipper, it is costs that are relative to the nation that matter. The net effect on the nation is the basis for NED economics.[53] [54] In harbor studies, net income to the owner/operator is a measure of benefits only when charter vessels are evaluated and only for existing charter users.[55] This project does not have charter operators as beneficiaries, however, net income to the owner was used as a basis for NED benefits in some parts of this analysis to demonstrate cash flow effects instead of opportunity cost effects. The net income estimates are considered to be reasonably certain given the fleet, harvest estimates, and number of days of activity. A high-side estimate would depend on use of opportunity cost.

15.23 Complications of Long Run Costs v. Short Run Costs

In harbor studies, limited entry fisheries complicate the NED analysis. When a vessel is delayed in a without-project condition, it might lose harvest time and therefore might not recover its costs. Where individual fishing quotas apply, such as in the halibut fishery, it is likely that the delay might result in a decreased harvest for the fleet taken as a whole. Regardless of the potential impact on harvest, costs are higher in the without-project condition due to inefficiencies related to delay and increased travel distance. This is an important NED concern.

A with-project condition can result in saving hours of wear and tear. This will effectively extend the productive earning life of a vessel and the fleet. Because there will be an extension of the productive life of capital (fleet replacement, individual vessel replacement, overhaul, modification, etc.), there is a lesser amount of capital used up hourly and annually in the harvest activity. This need to measure differences in capital consumption, without the project and with the project, requires consideration of long-run costs.

It follows that estimates of benefits for reduction in related transportation cost or benefits for commercial fishing in general should be based on the hourly equivalent of Long-Run Incremental Cost (LRIC). For NED analysis, the relevant difference in cost, with a project and without a project, are estimated by multiplying the hourly LRIC times the number of vessel operating hours with the project and without the project. This report used short-run costs, which are considered to be uncertain as a indication of long-run effects. A high-side estimate would depend on use of long-run incremental cost.

15.24 Accounting for all Effects

Some reports have used changes in short-run variable cost as a basis for NED benefits while others have used long-run or opportunity cost. The literature and official Corps' guidance indicates that use of short-run costs creates a potential mis-statement of NED economic effects in some cases by failing to account for all resource effects. However, it is also true that misapplication of long-run costs can overstate effects.

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[53] Ibid page 5-16, resource use is broadly defined to include all aspects of the economic value of the resource. This broad definition requires consideration of the direct private and public uses that producers and consumers are currently making of available resources and are expected to make of them in the future."

[54] Ibid para 5-3.

[55] Ibid paragraph 6-172 a.

Application of opportunity cost is typical of navigation projects where the entire cost of ocean going vessels or inland vessels is ordinarily reduced to an hourly equivalent. These costs include capital, insurance, maintenance, fuel, stores, and crew compensation. Projects that result in savings of time or travel distance derive benefits for delay reduction using differences in the total hourly equivalent costs not just differences in short-run variable cost. For example, the NED analysis of inland transportation or deep-draft transportation, looks into the difference in transportation cost not short-term variable cost outlays of the shipper.

In addition to comparison of with-project and without-project conditions, Corps guidance is emphatic in its use of opportunity cost to evaluate resources and project effects.[56] Limitation of an analysis to variable costs ignores the need to recover the huge capital investment in equipment and the project impact on capital recovery, which would be revealed by comparing LRIC with the project and without the project. This is an important issue when a project frees up resources that could extend the useful life of a vessel and increase the amount of income it can generate. It is also important, in the sense, that a project can reduce the amount of capital needed to support a vessel, or it can extend the number of years before more capital is needed. Use of long-run cost is standardized in Corps' data sources, such as used for inland navigation, deep-draft navigation, and rail cost.[57] A deviation from use of long-run marginal cost may result in an understatement of the benefits. The understatement is particularly present in the estimate of benefits for transportation savings, such as in reduction of trips to alternative ports. However, there is uncertainty regarding the estimated reduction in trips that probably overshadows the issue of which cost measure best accounts for all effects. Taken together these two issues mix over-counting and under-counting, and present a combined uncertain assessment for all transportation related benefits.

Table 27. Uncertainty Relation To Benefit Estimate

	Uncertain Analysis	Reasonably Certain	Reliable and Supported Analysis	Analysis Used in the Report	High Side Assumption and Analysis
Prevention of Damage	127.9			127.9	127.9
Prevention of Theft Loss	52.0			52.0	52.0
Prevention of Vandal Loss	21.0			21.0	21.0
Harvest Cost Reduction		360.3		360.3	377.0
Delay Prevented by Water Taxi Service		40.0	80.0	80.0	105.1
Transportation Savings for Scheduled Repair		540.4		540.4	1,018.8
Port Land Use Opportunity Cost			20.0	20.0	20.0
Vessel Haul Out			69.8	69.8	69.8
Transportation Savings for Disabled Vessels			198.3	198.3	396.6
Dock Replacement and Dock Haul Out			48.1	48.1	48.1
Subsistence Fishery		399.6	399.6	399.6	479.5
TOTAL	**200.9**	**1,340.3**	**815.8**	**1,917.4**	**2,715.8**

[56] Ibid paragraph 6-140. "NED costs are the opportunity costs of resource use."

[57] Ibid paragraph 6-59 e. This section justifies use of rates on the grounds they can be viewed as an estimate of LRIC.

16.0 LOCAL ECONOMIC IMPACT

16.1 Alaska Native Population

Beneficial impacts of the project will accrue to a population that is largely Alaska Native. Population of Saint Paul in 2000 was reported to be 585, of which 79% are Alaska Natives.

16.2 Impact Analysis

One way of measuring the contribution of a particular economic activity is to look at the amount of goods and services it sells and buys outside the local economy. A local economy has imports and exports similar to state and national imports and exports. Seafood, harvested by a fleet from Saint Paul, processed there, and then shipped to Washington, is an export that benefits the local economy. As a result of fishing success, the crew of the fishing vessel brings money to Saint Paul by supplying a product that is sold outside of the local economy. Exports from the local economy stimulate local economic activity.

Money from the local economic activity does not all stay there. This is particularly true of smaller economies, which are generally not self-sufficient. For them, many of the goods and services must be brought in from the outside. They are imports to the local economy. The money that flows out of the local economy to pay for these imports is referred to as leakage.

In larger economies there is less leakage, and as a result, the multiplier effect inside of the larger economy is larger as well. In smaller economic regions with less diversity, relatively more goods and services will be purchased from outside and the multiplier effect will be smaller. Therefore, in an island economy like Saint Paul multipliers are expected to be small. Unfortunately there is no input-output model available for Saint Paul nor is there sufficient reliable income and employment data available to generate a basic regional export base model to derive multipliers.

The cash sector of the local economy of Saint Paul is characterized by seasonal employment, a dependence on commercial fishing, local construction, local service jobs supported by the local, Federal and state governments; and relatively low cash incomes.

Development of a local small boat harbor will enhance prospects for development of an economic base that will be able to create jobs and bring money into the community. A harbor is essential to moving Saint Paul in the direction of an equal footing with other communities, which have employment based on development of extractive industries. Without a reliable transportation link, raw materials cannot be delivered to the local processor by a small vessel fleet. The small boat harbor introduces a cost reduction to processing at Saint Paul. It is transportation cost alone that has handicapped any economic development at Saint Paul, and the small boat harbor will alleviate some of the problem.

16.3 Harvest

The with-project condition will produce a minimum of 42 FTE harvest jobs. Under present conditions, the local fleet spends a few weeks fishing during the summer. Among the 26 vessels there are probably less than 10 FTE jobs even though there are a large number of fishers employed for a short period. A net gain in harvest FTE in excess of 32 jobs was estimated.

16.4 Multi-Species Processing

The planned processing expansion has excellent prospects for creating local employment opportunities. The overall market potential exceeds the potential local output, and the residual demand for island products will introduce a stabilizing force into the activity. The planned Saint Paul operation has significant economic advantages because the location indicates output can be achieved at less cost from Saint Paul. One of the crucial links in expanding the operation is that delivery to the processor must be quick, reliable, and cost effective. The harbor development is therefore essential to maximizing development of the community's multi-species processing. In the long term, the local industry offers diversification by developing packaged products that could be manufactured at Saint Paul.

As an upper limit to the future, direct seafood processing employment estimate at Saint Paul, knowledge was transferred from industry studies, related to other locations, and range data from various publications was adapted.[58] The data indicated that, on an annual basis for the Kodiak economy, it took as little as $40,000 of raw product to support one FTE. Reports in other industry journals and articles[59] place production per worker industry wide at 114,000 lb annually. Interviews with staff at two Alaska fish canneries estimated production rates as high as 200,000 lb of raw product annually, and an industry report on the subject set production in excess of 100,000 lb per worker during the 1980s. Production rates depend on the mix of inputs as well as the final product. A cannery, using only whole salmon as input and producing canned salmon, has the highest production per worker. A cannery, using cod or trawl caught groundfish and producing fillets, will have the lowest production rates.

Weighted average exvessel value at Saint Paul is $1.05, indicating a value per worker could be as high as $120,000 at a production rate of 114,000 lb of raw product per person. This was adjusted to one employee per $200,000 of raw product. The range in number of jobs created represents varying assumptions regarding the portion of local harvest that could be processed by new island industry. The multiplier was a downward adjustment from statewide data for the fishing industry as reported by ADF&G.

Near term impacts are a creation of from 10–50 jobs directly in processing, including 5–10 in management product development, packaging, and marketing. Including a multiplier effect assumed to be a factor of 2, based on the isolated nature of the island, indicates total related processing employment will range from 20–100 jobs. Data from Alaska's Economy and Payroll, Institute of Social and Economic Research, prepared for ADOT, dated March 1997, indicates a state-wide basic to non-basic employment ratio of .28, implying a multiplier could be as high as 3.6. Other sources, dealing specifically with the seafood industry in Alaska, indicate a state-wide multiplier for the industry ranging from 1.8–2.1.[60] Multiplier estimates are complicated by presence of non-resident workers and a large amount of non-resident investment, which tends to obscure data needed to analyze leakage estimates. The situation at Saint Paul is further complicated by the emerging nature of the economy, and the fact, the island is heavily dependent on supplies and services imported to the island.

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[58] Alaska Economic Trends, Department of Labor and Workforce Development, Sept 1999, Vol. 19, page 3.

[59] "Alaska Seafood Industry Vibrant Despite Problems", Seafood.com, trade journal, Nov 20, 2000, Laine Welch

[60] Alaska Seafood Industry Study, The McDowell Group, Juneau Alaska, May 1989.

There will be a continued economic leakage due to the isolated island nature of the economy. One estimate has placed leakage as high as 75%. This would imply an equilibrium basic to non-basic job ratio, and employment multiplier between 1:0.25 and 1:0.6.

16.5 Hospitality

The community is moving ahead with plans to promote tourist visits to the community, and the framework plan includes development of bed and breakfast, and restaurant operations for regularly scheduled tours. Community cultural resources, bird watching, and nature walks will entertain visitors, who may also be attracted to future development of local sport fishing opportunities. The small boat harbor provides the community with the opportunity to develop a sport charter fishing operation like no other. The charter operation will add stability to the fleet by diversifying dependence on commercial harvest. A secondary effect of a growing charter business will be an invigorated hospitality industry. Shore-side support for tours and service to vessels, making refueling stops, will create four additional jobs.

16.6 Marine Services

Management, operation, and maintenance of the harbor will require a harbormaster. Development of a vessel repair facility will employ a full time manager and four marine repair specialists.

16.7 Economic Base Impacts

The balance of jobs, which will be created, is a healthy balance between extractive industry and service-based industry. Half of the new jobs are considered to be export based, because they bring in dollars from outside the community. As such they represent the ideal foundation for economic development. There is little prospect of adverse shock impacts, because the new opportunities can be phased in as the community wishes. They are in a unique position to control the flow of local development.

Transfer effects from other communities will be insignificant or invisible as the new jobs are expansion of the economic base not transfers from other locations. The local development opportunities are therefore considered to be socially and economically integrated into the regional economy. Jobs created in the first round of local impacts are summarized below:

Table 28. Local Jobs Created

Basic Industry	Initial Export Based Jobs Created	Future Non-Basic Jobs	**Total Jobs**
Seafood Harvest	32	6–19	**38–51**
Seafood Processing	10–50	2–12	**12–62**
Hospitality	4	1	**5**
Marine	5	1	**6**
JOB ESTIMATE	**51–91**	**10–33**	**61–124**

16.8 Social Impact

The community is 79% Native, and ties to traditional subsistence lifestyle are valued. Subsistence becomes more difficult each year as pressure on the extractive resources of the land and sea are increased due to growing regional population and tourism. Saint Paul residents must provide for some regular cash income to fend off hardship during times when subsistence harvests are not bountiful. The community has seized the initiative to guide its own future by developing jobs that will be consistent with the lifestyle.

Development of a small boat harbor will expand opportunities for subsistence gathering and will also create the opportunity for a stable economic base. The economic expansion is not expected to stimulate growth in the population, because a local labor pool exists, and unemployment is a problem. The most likely future is one of expanded job opportunities for the residents, increased family incomes, and decreases in the number of persons at or below the poverty level.

Age and ethnic makeup of the population is not expected to change in the short run. Over the long run, young adults are expected to remain at Saint Paul rather than move to destinations where employment opportunities exist. Since there is not expected to be a measurable in-migration, there are anticipated to be no discernible adverse community effects, such as increases in crime, health problems, administrative expense, or environmental problems.

Exhibit 1. Comparison Of Annual Benefits and Cost ($000) for All Vessel Sizes